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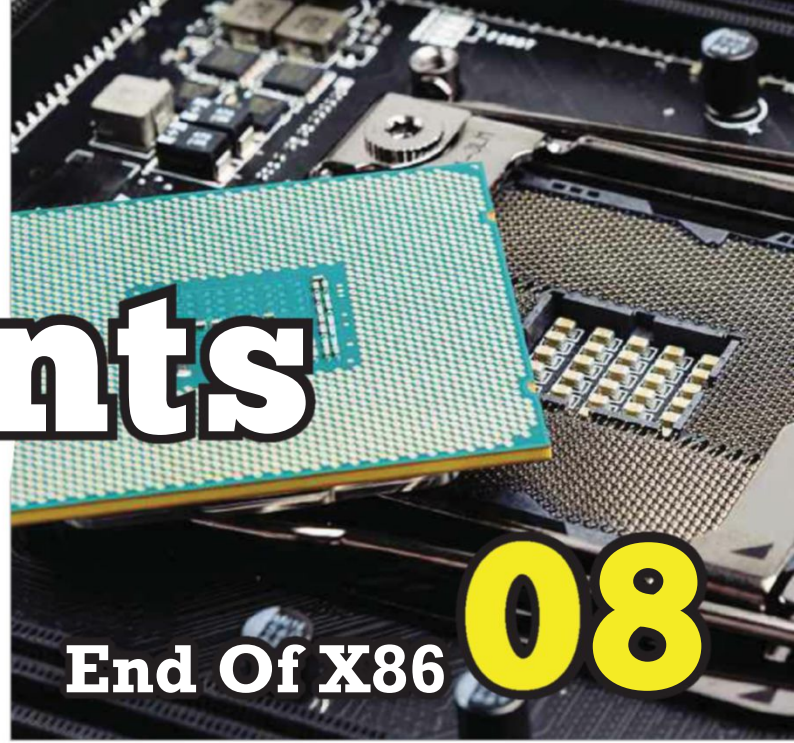
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08 End Of X86

Many years ago, the X86 processor architecture was created, and somehow it's still going. There have been attempts to replace it, but none have succeeded. Now, though, the rise of mobile computing might actually mean that X86 is on its way out – and that spells trouble for Intel and Microsoft. Mark Pickavance explains

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When Chromebooks were first announced, the idea was interesting, but many people rightly had their doubts about a stripped-down OS that relied so heavily on the internet to function. They're still being sold, though, and they've come a long way since the early models. Are they good enough for you, though? We've been finding out

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What better time than Christmas to think about zombie games? Okay, possibly any other time at all, but we've had zombies on the brain recently and somehow we managed to come out of it unscathed (okay they might have eaten a few cells, but we probably didn't need those anyway). Anyway, here are five of our favourite zombie games



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Is The X86 Era Coming To An End?

Mark Pickavance looks at the shifting relevance of Intel's X86 technology, and if it will soon be a thing of the past

The origins of X86 go back to 1978 when Intel released the 8086 processor, a 16-bit extended version of its previous 8088 series design. It wasn't an overnight success, because there were lots of chip makers then, and many of them had more popular support than Intel.

Early computer makers preferred the chips like the Z80 from Zilog, 6501 and 6502 by MOS technology, the 6800 series by Motorola, among others. But what propelled Intel's technology was IBM's choice to use it in its IBM PC in 1981 and the subsequent success of this platform in standardising Intel instructions and initially the MS-DOS operating system.

There's a core instruction sequence that the Intel or AMD CPU uses that originated in the 8088, even if the way these systems are coded is radically different and their internal architecture bears few similarities.

Having been around for nearly 40 years, is it time for Intel's X86 to retire from the world of computing, or is there still life in this legacy platform? To answer that, you need to really understand why X86 was so successful, and why changing conditions might eventually end its reign.

Bad, But Not Terminal, Yet

It's worth accepting from the outset that the PC as a platform has been in decline for some time. The advent of web-based applications, cloud storage, consumer devices like tablets and smartphones have all stuck a blade in the computer equivalent of Julius Caesar over the past few years.

Under these circumstances, Intel could usually rely on Microsoft to come riding to the rescue of its quarterly figures with a new version of Windows, but even that stalwart has failed to protect Intel.

Since the inception of the IBM PC, Microsoft and Intel have been the dynamic duo. When Microsoft launched a new OS, it usually needed more computing power, helping Intel. And when more powerful chips came to market, Microsoft was quick to find new things to do with that performance.

However cosy that all became, it couldn't shield either side from the economics of a changing computer market, one that is now radically different from what existed in the 1990s or even the early 2000s.

In Q4 of 2015, PC sales worldwide declined 10%, and they'd been declining year on year for six straight quarters, over a period when Microsoft launched Windows 10. That brings the PC sales to the same point they were at in 2007.

Oddly, after that, lots of pundits then declared that this was a turning point, as the PC would recover in 2016 from the doldrums. It didn't. In the first three months of 2016, it lost another 9.5–11.5%, depending which analysis you wished to believe.

Fearing a mass exodus of shareholders, Intel quickly announced it would be cutting 11% of its global workforce and diversifying into other markets. Looking at the latest briefings Intel has generated, it's now talking about IoT and cloud computing platforms as making up the shortfall created by the PC decline. This



▲ *Having made plenty of noise about how it could create a power efficient X86 processor for phones, Intel cancelled that project without selling any chips to the big phone makers*

comes despite it cancelling its phone chip Medfield, after \$10bn reportedly went into that hole, and failing to gain any traction in the tablet market with its Atom processors.

While the PC market is still big, surely this is a train Intel wants to alight before it really hits the buffers?

Well, it's tried to engineer an untimely end for its X86 architecture in the past and failed rather miserably.

Attempted Fratricide

The popularity of Windows has revealed to Intel's chip engineers the numerous flaws of the X86 chip series, especially when it comes to handling multitasking and the potential path for 64-bit addressing.

X86 wasn't designed to be as flexible as the PC became, and on numerous occasions, the cracks in bending it to the new paradigms have shown. At each chip iteration, Intel layered more modern thinking on old structures, in a curious parallel of the problems that Microsoft ran into improving Windows while retaining backwards compatibility.

Many of those working on these projects just wanted to ditch X86 and the old thinking that it represented, and start on a totally new chip with none of that legacy baggage dragging along behind. Eventually, senior people in Intel began to listen, and a whole new chip architecture was envisioned that would be so massively superior that it would sweep X86 away and usher in a whole new generation of personal computing.

Inspired by the work that HP did on Explicitly Parallel Instruction Computing (EPIC), Intel started work on a chip that would do more in a single clock cycle and use a whole new IA-64 architecture. In 1999, it officially named the chip Itanium, and it forecast that it would be selling \$38bn a year of these chips by 2001.

That never happened, partly because Intel didn't actually release the first chips until June 2001, but it was a target that this chip would never achieve, even if technically Intel still sells variants of them to this day.



▲ *Intel once tried to kill off X86 itself with the Itanium, but it failed to make a compelling reason for many to shift*

Because the Itanium couldn't natively process X86 instructions, it was initially seen as an alternative to the UNIX RISC workstation processors like those made by SUN (SPARC), MIPS and DEC (Alpha).

Due to the size and power of Intel, many initially took the Itanium very seriously and set about compiling a version of their operating systems for the new architecture. These included Windows, OpenVMS, Linux and a selection of UNIX derivatives.

“ The popularity of Windows has revealed to Intel's chip engineers the numerous flaws of the X86 chip series ”

Some got cancelled before they were finished, and those that did arrive only highlighted the problems of usurping X86 in the general use computer market.

Having Windows for Itanium is fine, but what you need is the applications, and without X86 compatibility, that meant specific versions made for AI-32 or AI-64 to run of those recoded Windows



▲ *Microsoft did make a number of ARM-based Surface machines, but Windows without Windows apps didn't really seem a viable concept*



▲ Intel would like to be embraced by Android, but it's yet to make chips to specifically support that OS

models. Oddly enough, this was exactly the same brick wall that Microsoft would run blindingly into with the ARM-based Surface machines years later, because who in their right mind wants a Windows computer that can't run Windows applications?

Intel tried to patch over these limitations with X86 emulation code, though the processor was horribly slow at doing this, and it wasn't that quick running native code either. Itanium soon became something of a joke, where Intel would avoid saying how many it had sold and would hide its commercial impact among other more profitable parts in its business.

In the end, only HP continued to sell systems based on this line, and leaked documents revealed it was forced to pay Intel to keep developing and producing the chips to meet its specific needs.

In retrospect, while retrofitting X86 with the functionality it needed for modern computing tasks was challenging, it allowed the type of transition that the market could accept rather than the drop-dead move that Itanium presented. Perhaps if the Itanium had been a better design from the outset, things might have been different, but it never really competed with the X86 chips that Intel itself and AMD built (the Opteron) to make the switch justifiable.

Death By Irrelevance

While Intel's own Machiavellian attempts to do away with X86 failed, other technologies have been stalking this architecture for some time. Probably the one that most people are aware of is ARM, a chip technology that has all but dominated the mobile phone and tablet markets.

What's radically different about ARM when compared with Intel is that ARM doesn't make all the chips. Instead, it licenses its technology and lets others pick-n-mix a SoC (system on chip) of their own recipe. By doing this it controls the core functionality and architecture, but others can customise their package to include exactly the sort of power and performance that their application needs.

That's the polar opposite of Intel's solution, where it decides everything, and you only get to decide in broad strokes of clock speed and cache what level you want.

ARM has also spent most of the last 30 years focusing entirely on power efficiency – something Intel spent many years almost entirely ignoring. Having missed the explosion of smartphone use and the multi-billion dollar chip sales that it represented, Intel tried in vain to catch up with its own power-efficient X86 phone chip, a project it's since abandoned.



Where Itanium failed to oust X86 because of the transition issue, ARM has arrived from an entirely different direction, where the computers that it's in are effectively appliances and not personal computers in a conventional sense.

Because of this, they haven't been in direct competition, with the possible exception of the failed ARM-based Microsoft Surface machines, and therefore people don't expect these devices to be a PC and run X86-based code.

Now we're seeing systems, like those that run Android (a Linux derivative) and Chrome OS where both ARM and Intel processors are being used, with few of the customers noticing – or caring – what chip they actually use.

Cloud based computing and the web interface are achieving what Intel's chip designers failed to do in making X86 largely irrelevant in the future of computing. That's not to say that it won't be with us for a long time yet. Windows is still popular, though the market for PC technology is in a gradual decline, from which it will probably never recover. Whereas 20 years ago having a computer with lots of useful applications invariably meant X86 and Microsoft Windows, those things are no longer mandatory.

The continuation of X86 chips by Intel may be more about the cost to the company of designing something new versus the ease of delivering technology it fully understands that can work with both legacy Windows customers and those that want a more powerful platform for Android or Chrome OS, or their inevitable love child.

Final Thoughts

Before we get ahead of ourselves, it's worth noting that Intel still sells hundreds of millions of chips every year, and AMD flogs a decent number too. It would be crazy for them to stop, as they still make a considerable amount of money out of doing this and will do for some considerable time to come.





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▲ *With Microsoft working alongside it, Intel could do no wrong, but we're not in the same world now, where the i486 was hailed as the best computing platform ever built*

But what made X86 successful wasn't Intel alone; it was how in coordination with Microsoft it managed to appear more relevant than it actually was in reality. That relationship is breaking down, because Microsoft isn't as relevant as it once was, and they each can't prop up the other through these difficult times.

I should note that Microsoft has supported technology other than X86 in the past, but not successfully, and today it only really supports ARM on Raspberry Pie and the few mobile phones it managed to ship Windows 10 onto before it entirely lost interest in phones.

It's clear from its Universal App platform that it really wanted to migrate away from X86 and all its associated legacy baggage, though both the ARM Surface and its phones didn't provide the impetus. That leaves Microsoft in a difficult place, because it doesn't really want to remain indefinitely tied to the X86 architecture, but at this time it doesn't have a practical alternative or a working plan to ween its customer base off X86-dependent code. Intel would prefer that it didn't, but it doesn't really have a say or that much influence with Microsoft these days.

As the market forces have affected both companies, they've realised that while they were strong together for so long, they both need to find a way out of this hole that isn't dependent on each other.

My motivation in writing about X86 was that I realised how little we've covered developments at Intel in the magazine over recent years. If asked what the fastest Intel PC chip available was, I'd hazard a guess that it was an LGA 1366-v3 Xeon, but I've no idea what clock speed or cache size it features.

Going back a few years, I knew the range of chips that Intel made intimately, and I was always eager to review significant new releases. These days, I'm not sure people really care, other than to mentally segment Celeron, i3, i5 and i7 performance levels in very general terms.

While this is an understandable disinterest for the general public, I'd consider myself and those that read this publication to be computing enthusiasts. If we can't summon up any great excitement for what Intel does with its chip technology, then that's pretty indicative of the current situation in regard to X86's longer-term prospects.

This isn't exclusively an Intel problem either, because video card development also seems of much less interesting than it

once was for many.

Reflecting back on those times when it was all edge-of-the-seat product launches, the PC became like a compelling narrative, and we all wanted to see what happens next. Now, it has become a wholly predictable exercise where the clock speeds shift up in glacial increments, and simple upgrades are thwarted by arbitrary socket changes or exotic new memory types.

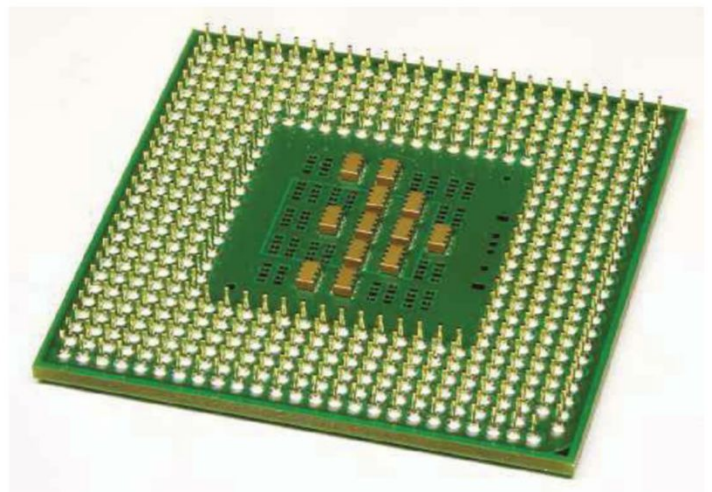
Where we once looked at each new release to finally deliver the performance that a favourite game craved, these days most titles are playable with the most modest power. And seeing all the settings put at maximum while using 4K resolution is purely an expenditure issue. The PC has become purely pay-to-win, and when you realise that, then it's dramatically less interesting.

X86 can't complain. It had a good run and saw many of the chip families it started out alongside biting the dust along the way. The technology that will replace it will probably have codes and notation that few people will even know or care

“ Cloud based computing and the web interface are achieving what Intel's chip designers failed to do ”

about, because it's now all about what a thing does than how it does it.

X86 was the glue that made Intel and Microsoft work in combination, and without it in place, we will likely return to an era very much like the one that we last experienced in the early 80s. That was an exciting time for computer enthusiasts, and maybe like then, computer development is about to get a lot less predictable. **mm**



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Could A Chromebook Satisfy Your Computing Needs?



▲ The HP Chromebook 11 is a fine budget notebook computer running Chrome OS

A cheap, portable notebook running Chrome OS could be all you need for a second computer, says Roland Waddilove

There is more variety in computer hardware than at any previous time and we are spoilt for choice when it comes to choosing a new computer. There are desktop PCs, laptop PCs, hybrid PCs, Apple Macs, and Chromebooks. So what should your next computer be?

You may have heard of Chromebooks, perhaps even seen one advertised or on the shelf at a computer store, but what exactly are they and what can you do with it? Google creates more than just apps for phones and tablets and browsers for your computer, it puts a lot of time and effort into creating operating systems too. Perhaps most notably, it created and maintains Android for phone and tablet manufacturers to put on their devices, but it also created the Chrome OS for computer manufacturers to put on their computers. Thus, laptop and desktop computers designed to run Chrome OS are called Chromebooks or Chromeboxes.

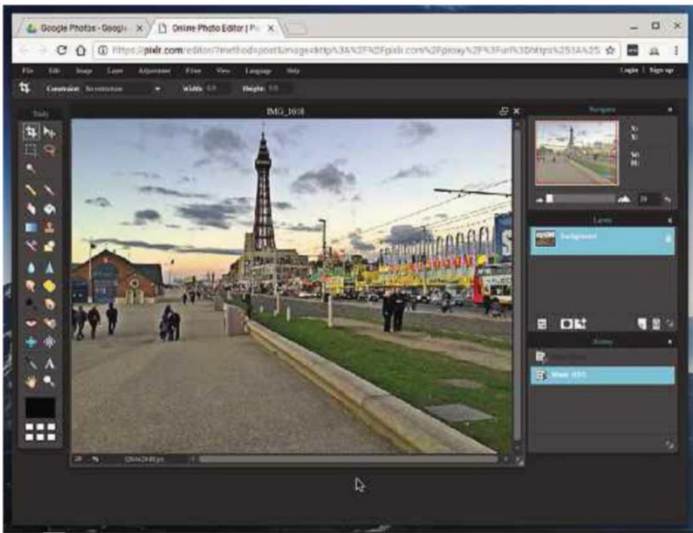
You can do quite a lot with a Chromebook, probably more than you think. Whether one is suitable for you depends a lot on how you use your computer, and it will suit some more than others.

As you would expect, Chrome OS is designed to work best with Google's services, so if you are already a user of Gmail, Calendar, Keep, Maps, Docs, Photos, and other Google services, you are the potentially the perfect Chromebook user.

These computers are not just for users of Google services, though, and there is more to them than you might think. The software you can use with a Chromebook isn't as extensive as with a Windows PC, but it might be sufficient for your needs – so, if you already have a PC (especially a desktop) you might want to consider a cheap Chromebook as a second computer.

What Hardware Specs Do You Need?

The hardware specifications required to run Chrome OS are much lower than for a Windows PC. This is partly because it is a simpler operating system that does not need to be able to run an extensive range of modern applications. All a Chromebook has to do is run Chrome, a web browser, and perform a few other basic tasks. This means that powerful hardware is not needed.



▲ Photo storage is free and unlimited and images can be edited in Pixlr online photo editor

online versions of Office apps run in a browser on any computer and any OS, including Chrome OS on a Chromebook. This means you can read, write, and exchange Office documents with other Office users just as if you had the software installed on a Windows PC. Microsoft's online apps are really nice. They have limitations, of course, and some advanced features are missing. As we've discussed, however, it's doubtful you use them anyway.

There are other free online office suites, and also free online accounting and invoicing from Wave (waveapps.com), QuickFile (quickfile.co.uk), Pandle (pandle.co.uk), and others. Working on a Chromebook is easy.

Photo Storage And Editing

Google provides free and unlimited storage for your photos up to 16 megapixels in size and all you need to do is to put the Photos app on your Android phone or iPhone. Photos are automatically uploaded to photos.google.com and they will also appear in Google Drive too. You can view them in Chrome, create albums, delete bad photos, and watch slideshows.

Google Photos has some great features for editing images online within the browser, like automatically creating 'stories' from pics taken on trips and holidays, stitching together panoramas from overlapping photos, or auto-edited videos. It also has some basic photo editing functions, where you can easily adjust the exposure, colour balance, and contrast; add one of over a dozen special effects filters, or perform crop and rotate edits. Alternatively, Pixlr (pixlr.com) integrates with Google Drive, so you can click an image and open it in the Pixlr editor, make changes, and save it back to your online storage. Pixlr isn't Photoshop – and it isn't even close – but it is good enough for most photo editing and image creation tasks.

There are other options too, such as Polarr Photo Editor and Ribbet Photo Editor. All of these can be found in the Chrome Web store and can be added to Chrome.

Music And Audio

Some people have large music collections stored on their computers, but audio libraries are being replaced by streaming. Sign up to a service like Google Play Music, Spotify, Deezer, or Microsoft Groove and you can stream music through Chrome using the web apps in lieu of using local storage for MP3 files. Those are subscription services that cost money, but there is a way to

stream your music for free on any computer, phone and tablet, Chromebooks included.

If you upload all your music tracks to the Music folder on Microsoft OneDrive (onedrive.com), you can then use the Groove music player to stream the music. You are limited only by the space you have on OneDrive, but that's a good workaround for tunes that may not be available via streaming services. Alternatively, upload all your music tracks to Google Play Music and you can stream the music from there to your Chromebook, or any computer or device. Google lets you upload 50,000 tracks and store them for free. That should be sufficient for most people.

Chromebooks are great for music and you can subscribe to unlimited music streaming or upload your own music library for free and stream it.

“ Google Photos has some great features for editing images online within the browser ”

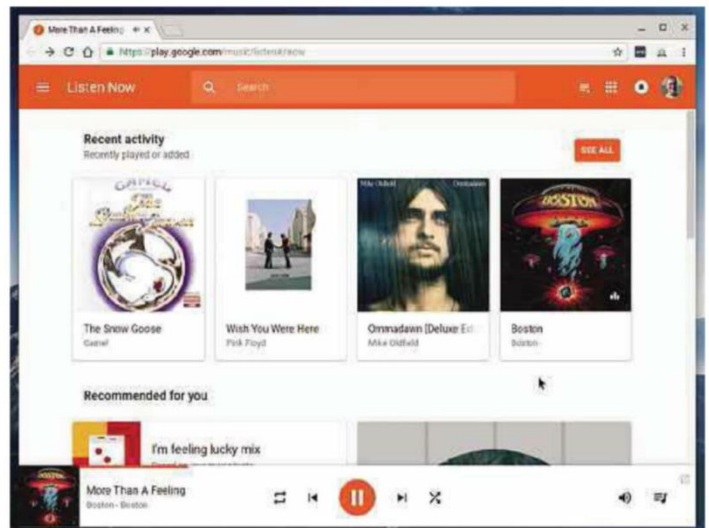
Video Storage And Editing

This is a weakness with Chromebooks, and they are not ideal for storing and editing videos. If you only rarely shoot video clips with your phone, you can upload them to Google Drive, OneDrive or some other online storage. They can then be accessed from a Chromebook using Chrome.

WeVideo (wevideo.com) is an online video editor that can access videos stored on Google Drive, OneDrive and Dropbox, so you don't need software installed on the Chromebook or even to store video locally. Working with online storage and editing is not suited to long videos, but it is okay for mixing and editing short clips.

Games And Entertainment

This is another weakness with Chromebooks. Put simply, they are not good for games players. There are some entertaining browser based games that are good for casual players, but if you are serious about games, you need a PC or a console.



▲ Upload your music library to Google Play Music and stream it, or use OneDrive and Groove

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▲ *Dell's Chromebook 13 is one of the best, but the top of the range model is expensive*

To see what games are available, go to the Chrome Web Store (chrome.google.com/webstore) and select Games on the left. You might want to try *Kingdom Rush Frontiers*, *Command and Conquer Tiberium Alliances*, *Soccer Manager 2017*, *Cut The Rope* (and its sequel), *Tank Riders*, and *Forge Of Empires*.

Best Chromebooks

ASUS has a range of Chromebooks and there are five at the UK store (bit.ly/2floQSL). Some have been around for quite some time, like the Chromebook C300, but if you specify 4GB of memory and a 32GB disk, you get quite a capable notebook computer. It has a 13.3" display, but it only has a lowly 1368 x 768 pixel resolution. It has plenty of sockets and these include USB 2 and 3, HDMI, SD card and micro Sim. It sells for around £199 with 2GB of RAM.

For the same price, you could have an ASUS Chromebook C201 and this has twice the memory at 4GB, but half the disk space with 16GB of storage. Remember that most of your files will be held online, so the small disk isn't that much of a limitation. The screen size is 11.6" and the Chromebook weighs less than a kilo. It has two USB 2 ports, mini HDMI and micro SD card. If you don't mind the small screen, it's not a bad Chromebook.

A lot of Chromebooks are small, light, highly portable notebooks, but the Acer CB5-571 has a large 15.6" screen and other hardware specifications to match. It is powered by a Celeron 3205U CPU, has 4GB of RAM and 32GB of storage. It is big and heavy (for a Chromebook), but it has laptop-like specifications and that HD 1920 x 1080 screen is as big as you will get. Surprisingly, the price is fairly low and it is £229 or less.

The HP Chromebook 11 is ultra-portable model with an 11.6" screen, 16GB of storage and up to 4GB of RAM. It is only an extra £20 max out the memory, and it is worth it for a total of £219. It is powered by a Celeron N3060 processor running at 1.6GHz with a burst that takes it to 2.48GHz. That wouldn't be enough for a Windows PC, but it is okay for a Chromebook.

Dell has some of the best Chromebooks and if you are prepared to pay a bit more than the other models mentioned so far, the Dell Chromebook 13 is excellent. There is a wide range of models and the price starts at just over £200, but rises to over £1,000 for the top specification, which would buy a good Windows laptop. The hardware justifies it, though.

Specify a top of the range model and the screen is a 13.3", HD 1920 x 1080 pixels, touch sensitive display. That's a high resolution for a small screen and you can tap and swipe using the touch features. CPUs up to an Intel Core i5 5300 running at up



▲ *The HP Chromebox is a tiny desktop PC that can be used with your own keyboard and monitor*

to 2.9GHz are available, and you can also have 8GB of RAM and 32GB of solid state storage. It is one of the best Chromebooks you can buy and is nice if you can afford it.

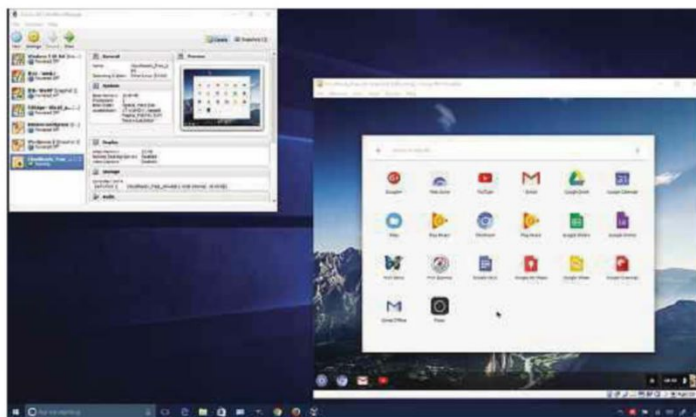
There are also desktops that run Chrome OS, including several versions of the HP Chromebox. The cheapest has similar specifications to notebooks; an Intel Celeron processor, 4GB RAM, 16GB disk, and so on. It has more sockets, though: four USB 3, HDMI, LAN, and SD card. It costs £273, but there is a £713 version with a Core i7 CPU with 8GB RAM.

Try A Chromebook For Free

So, would a Chromebook suit you? Why not try one and see! Chrome OS can be run in VirtualBox, so if you don't already have it, go to virtualbox.org, download it, run it, and install the extensions pack. Then go to bit.ly/2dshMjz and download the VirtualBox image of Chrome OS. It is just over a gigabyte, so it might take some time.

Run VirtualBox and use the Import option on the File menu to import the Chrome OS file you downloaded (unzip it first). You can then Start Chrome OS. It is possible to log into Chrome OS as a guest, but it is severely limited. Log in with a Google account, such as your Gmail email and password, and you have access to all the features.

Open the browser, go to the Chrome Web store and install some apps. If the mouse gets stuck in the Chrome OS window, just press the right Ctrl key to access the Windows desktop. Chrome OS seems strange at first and you have to forget what you know about computers and think about online apps, online storage, streaming music and movies, and online photos. You get used to it after a while. [mm](#)



▲ *VirtualBox running Chrome OS in a window on the desktop in Windows 10*

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Visual Effects

Lee Bell explores the technology behind Hollywood's biggest blockbusters

The level in which visual effects play a role in making a Hollywood blockbuster of today's standards is rather phenomenal. It's obvious when you're watching films such as Independence Day: Resurgence, Ant-Man and the never-ending X-Men sequels that they use a tonne of computer-generated imagery (CGI). But it's not until you take a close look at the post-production process that you fully understand the true role digital effects play in bringing these movies to life.

Although many of Hollywood's biggest blockbusters are filmed in huge studio sets in LA, quite remarkably it's what is created within post-production studios scattered around London's Soho in many cases where the



◀ The protagonist's superhero mask in Ant-Man was built up, layer by layer, using CGI. The mask didn't actually exist in real life



▲ *The making of Independence Day: Resurgence, with the top picture showing the scene before the CGI had been added (bottom)*

true magic happens. In the basements of independent visual-effects companies, under the Michelin-starred restaurants and trendy cocktail bars in this thriving neighbourhood, small production teams painstakingly work at building up layer upon layer of CGI to not only give these movies an edge, but in most cases, to create a majority of the scene that enables the narrative.

One of the most prominent of these post-production visual effects companies is Cinesite, an independently owned animation studio. The company is known for delivering high-end effects and creating photo settings that make an invisible but flawless impact on every scene. The company has so far worked on some of the most iconic films of the past few years, including *The Revenant*, *Deadpool*, *Chappie* and *Jurassic World*, as well as a number of films from the *Harry Potter* and *James Bond* franchises, such as *Spectre*.

Behind The FX

In order to create these intricate and complex visual effects that make it impossible for audiences to tear apart real film from CGI, Cinesite requires a very high level of computing power.

And what gives the studio the power it needs to create feature-rich scenes that help audiences forget that what they are watching was mostly devised on a computer screen? An intelligent guess would be a high-spec Apple Mac. But no, old-time PC vendor Dell is the company powering Cinesite's movie artistry.

Cinesite teamed up with Dell in June as it needed a vendor to work alongside its team to update and rejuvenate its infrastructure away from a physically confined data centre.

The studio chose Dell to deploy the latest 'future-ready' workstations to tackle physical restrictions through secure, always-on and sustainable co-location facilities. As a result of the partnership, Cinesite has been able to increase business and technical agility with greater scope for creativity in the face of shrinking production schedules.

Together, the studio and Dell are working to further the art of visual storytelling. Shows currently in production are *Fantastic Beasts and Where to Find Them*, *Assassin's Creed*, *Charming* and *Power Rangers*. Cinesite's other recent movies include *The Man From U.N.C.L.E.*, *Skyfall* and *San Andreas*.

But what exactly is Dell providing to ensure Cinesite has by far enough compute to power its demanding workload? The US computer firm has provided the movie studio with some pretty beefy workstations, but it hasn't just thrown in its most powerful systems.

Specs Appeal

The Dell workstations Cinesite uses to power its advanced CGI creation and rendering are bespoke to the studio's different departments, depending on the task. For example, different artists require different specs and, although having the same hardware for every artist would be convenient, it wouldn't provide adequate performance in a cost-effective way.

The main workstations Dell has provided are the Precision Tower 7000 Series (7810) and the Dell Precision Tower 5000 Series (5810). The main difference between the two models is the number of CPUs: the 7810 has two CPUs to the 5810's one.

Effects artists and lighters are usually the ones who benefit the most from having very powerful CPUs and a large





▲ CGI helped to bring Ant-Man's Yellowjacket to life

amount of RAM to speed up simulations or interactive rendering.

The 7810 workstations used in the effects and lighting departments are powered by dual Intel Xeon E5-2643 v3 CPUs running at 3.4GHz with 6x2 cores. They're joined by a whopping 64GB of 2,133MHz DDR4 RAM and an Nvidia Quadro K4200 graphics card.

Texture artists, who artificially paint surface textures on animated characters, environments and props, work on machines that require a more powerful GPU. The same 7810 workstation with Intel E5-2643 v3 CPU and 64GB RAM configurations are used here, but alongside a more powerful Nvidia GeForce GTX Titan GPU, which powers systems so they can smoothly run the high level of detail needed in creating intricate animations.

"Many other artists such as animators have not traditionally benefited from a high number of cores. Although this is changing, for these artists we have favoured CPUs with higher clock speed and fewer cores," Cinesite tells us.

Therefore, animators use the 5810 systems that are powered by an Intel

Xeon E5-1650 v3 CPU running at 3.5GHz (six cores), alongside a slightly lower 48GB of 1,333MHz DDR3 RAM and Nvidia GeForce GTX 970 graphics.

But what creates the greatest workload in powering the studio's animations is Dell's render nodes, which are machines or processors that can be used to process the rendering of a visual effect. By joining up render nodes on a network, Cinesite and Dell have created a super-powerful render farm, which ensures animations don't take an age to process after the design process. This render node is based off-site, and processing the renders remotely in a data centre over the cloud helps save space in the studio's London offices. And as anyone who has even a vague understanding of London property prices knows, space saving here is vital for cost effectiveness.

The studio's current render nodes are powered by a dual Intel Xeon E5-2680 v3 CPU clocked at 2.5GHz, a massive 2x12 cores.

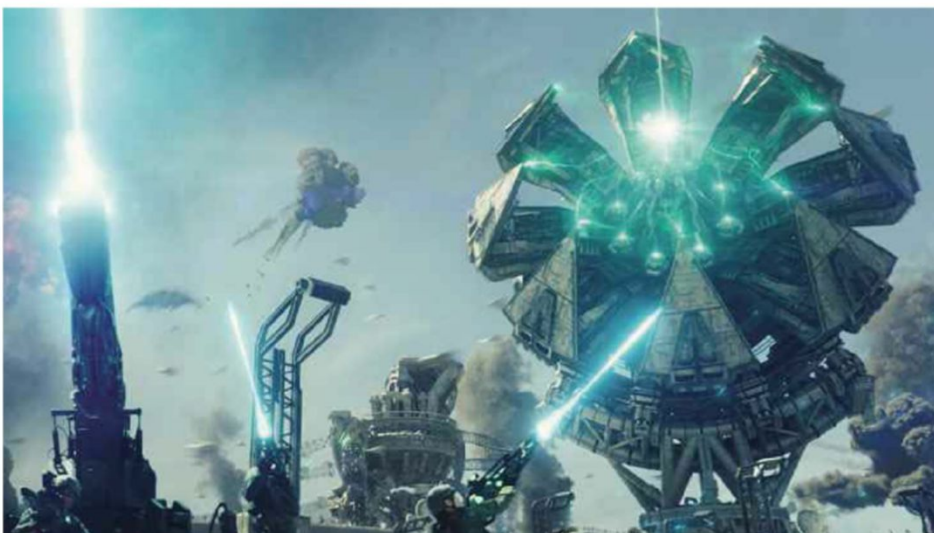
"The render nodes also require a significant amount of RAM and compute to produce the company's renders,"

adds Cinesite, stating that a node has a whopping 160GB of DDR4 RAM.

"Very large and heavy render jobs such as CG renders of complex scenes will normally use all the resources of the render nodes. For less demanding jobs such as compositing renders we normally split up the compute power and RAM into multiple slots that can run multiple jobs concurrently."

However, powering the Cinesite studios is not just about computational horsepower. As with any power-heavy computing, there comes the issue of space and storage, both digitally and physically.

Before the rollout of Dell's systems, Cinesite's computers took up a lot of physical space. With the new close involvement from Dell, all the machines – with the exception of the CG and VFX artists' workstations – are based remotely in the data centre, so all the number crunching is done in the cloud. Again, this saves valuable space in a



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“ It’s not until you take a close look at the post-production process that you fully understand the true role digital effects play ”

place where each square metre of land is worth thousands.

Day Of Reckoning

One of Cinesite’s biggest recent projects was *Independence Day: Resurgence*. While it came as no surprise to the studio that this would be a big job in terms of CGI, the sequel was of overwhelming scope, with more moving CGI elements than the average Hollywood action film, and certainly a richer visual complexity than its predecessor of 20 years ago.

The movie was so big in terms of demanding visual effects that Cinesite wasn’t working alone on the project, and shared some of the workload with several other animation studios, which each worked on different aspects of the film. Nevertheless, storage for Cinesite alone topped more than a petabyte – equivalent to 1,000 terabytes, or a whopping one million gigabytes – for all the effects, assets and rendered final footage.

However, the Dell setup meant the studio was actually able to use fewer computers in the building than on previous smaller-budget movies, while still achieving a positive impact on both cost and production.

During our visit to Cinesite, we saw footage from the making of *Independence Day: Resurgence* as well as *Ant-Man* and, alongside the finished footage, saw breakdowns of the VFX work before and after its application.

The level of visual effects that are applied to these films is outstanding, and quite shocking once you see the difference they can make to a film. In *Ant-Man*, for instance, the protagonist’s superhero mask was never actually worn

on set. In fact, it didn’t even exist. The mask was built up via CGI, layer by layer, on every frame in which it featured. A physical mask would have “made his head look too big” on camera, the Cinesite effects team explains, so it had to be computer generated.

Cinesite’s effects also had a huge impact on *Independence Day: Resurgence*. Before the CGI was added, most of the film was nothing but bare landscapes with minimally dressed actors. Most of the action, especially during fight scenes, was the work of the effects studio.

Cinesite spent hours adding hundreds and hundreds of spaceships for the battle shots, where the fast-paced action of rapid-fire laser beams soaring across the sky had to be digitally added one by one. You’ll see from the before and after photos (opposite) that this eventually made for a very intricate scene with a great range of detail for viewers, who are probably unaware of the effort that goes into achieving a realistic-looking scene of aliens being blasted into smithereens across the sky.

Even if we’d seen these scenes at half or even an eighth of their normal speed, it would have been difficult to take in, such is the complexity and the intricacy of the projects and the number of working hours that are spent on creating them. It’s therefore easy to forget that you intentionally don’t see a lot of the visual effects on the big screen, and at the same time, it’s impossible to guess the depth of the achievements.

So next time you’re watching a Hollywood blockbuster, try to spot where reality ends and CGI begins. If Cinesite and Dell have been doing their jobs properly, you probably won’t have a clue. **mm**





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5 Great ZOMBIE Games

Bad news: the dead want to eat your brains. But on the plus side, it makes for a good PC game or two...

Like the undead's craving for human brains and flesh, the public's appetite for zombies shows little sign of waning. No matter how stomach-churningly gory *The Walking Dead* gets, no matter how many times *Dawn of the Dead* gets a new remake or sequel, zombies are still a big deal. And nowhere is that more evident in than in the videogame market, where taking on hordes of reanimated corpses has become the inspiration for a huge number of titles.

But with such a huge number of games to pick through, which ones are worth your time? Well, here are five our favourites. And with this little blood-soaked lot, it won't just be Santa who's wearing red this Christmas.

1. The Walking Dead (£18.99 per season)

Let's kick things off with a name that we're all familiar with, one that has become synonymous with the zombie genre, thanks mainly to the TV adaption of its comic-book source material: *The Walking Dead*.

It's made by Telltale Games, and much like the rest of this developer's output, it's an episodic, point-and-click adventure, with each part being released a few months apart. And through this publishing method, there have been two full seasons of the game, as well as a couple of shorter spin-off series (plus a new series on the way).

Although it's set in the same universe as the comic book, *The Walking Dead* game is filled mainly with original characters, with just a few appearances from more familiar faces. But even though the cast is

new, the character development is top-notch, and by the time the final moments of each series roll around, you'll find it difficult not to get a little misty-eyed – especially seeing as the decisions you make can often be the cause of what goes wrong.

2. Killing Floor 2

The first *Killing Floor* game was originally an *Unreal Tournament 2004* mod but the modders, working with the *Red Orchestra* developer Tripwire created a new version of the game, which was given a full release on Steam in 2009. The sequel, based on Unreal Engine 3, is a far more polished experience, but the idea is the same: you and up to five other players are attacked by hordes of zombies, and you need to use various weapons to survive.





Technically, they're not actually zombies but 'Zeds' – undead mutant, basically – but that's good enough for us. Unlike traditional zombies, rather than being slow, they move at a pace, and there are a few different types of Zeds, some of which are much stronger or which have special abilities. The Scraze, for instance, is a huge, muscle-bound figure with a chainsaw arm and a bad temper.

The game can be played solo, but it's really designed as an online, co-operative affair, and you have to play online to rank up the various player classes, each of which has its own weapons and skills. The demolition class, for example, uses a range of explosion weapons, and he also gives grenades to his teammates throughout the game.

Each game is played as a series of rounds, between which you buy new weapons using money you've earned by killing Zeds. And as well as earning cash, you gain XP, and after a while you rank up, earning new abilities and strengths.

It's a simple, all-out action game, but if you like shooting guns and making things blow up, it's well worth a look.

3. Plants Vs Zombies (£4.25)

If the zombie apocalypse were ever to happen for real, you probably wouldn't expect horticulture to be an effective way of staying safe. That, though, is exactly the premise of *Plants Vs Zombies*, a tower defence game that sees you fighting off the living dead with a range of animate flora.

Playing as an under-siege homeowner, all that stands between you and the zombies eager to eat your brain is whatever you can plant in your garden. As they slowly but steadily stumble towards you, your plants either destroy them or hinder their progress in some other way.

As well as the weaponised plants, you also have ones that will drop 'sun', which is essentially the money you use to buy more plants.

As a last line of defence, you have a series of lawnmowers, which will automatically take down a row of zombies if they reach the end of your garden. But each lawnmower works only once, so that row will be exposed after that.

It's a simple, addictive titles, and it's been ported to numerous formats, including Android and iOS. However you play it, you're practically guaranteed to enjoy it.

4. Left 4 Dead (£14.99)

Another multiplayer co-op game, *Left 4 Dead* was created by Valve, the company behind things like *Half Life*, *Portal* and the Steam service itself. Unlike *Killing Floor*, the enemies are actual zombies, but it shares a similar system of also throwing in 'special' enemies, which have their own abilities and strengths. For example, the Tank, as you might expect is much larger and stronger than regular zombies.

The game is played in numerous ways, including a campaign mode, which sees you working your way across levels and finding safe houses along the way; survival mode, where you aim to stay alive for as long as you can before being overwhelmed; and versus, where you and three others play against another team of four, and in which you get a chance to play as the zombies yourself.

The sequel, which also costs £14.99, takes all this and adds more gameplay modes, new weapons, new enemies and a whole lot more. If you can afford to buy both, then they're worth it, but if not, then you might be best off skipping straight to part two.

5. Rebuild 3: Gangs Of Deadville

Let's slow things down a bit for our last game. In this relatively simple but nevertheless addictive strategy title, you take control of a group of zombie apocalypse survivors. It's your task to keep them alive, scavenging useful items from buildings and equipping them with the tools and weapons they need to survive.

But there's more to *Rebuild* than just pointing your people at the undead and telling them to put them down. Each survivor has their own individual skills, which makes them suitable for particular roles in your community. Some of them, for example, are better suited to farming, providing food for the rest of your people, while others are scientists, who should be put to work on researching new technologies, including defences. That doesn't mean you can't get them to do other things, though, because they can also be taught to take on other roles more effectively.

Of course, it wouldn't be a zombie game if there wasn't some danger. But as well as having to deal with hoards of walking corpses, you also need to take into account other groups that live around your settlement. Here, you can either try diplomacy, possibly leading to collaboration, or you take a more ruthless approach... [mm](#)

Remembering...

Jumping Jack

Loony limericks and leaping lads this week

It may not be the most revered or even remembered Spectrum game of the early 80s, but that's not to say *Jumping Jack* was without merit. True, it's a very basic looking game, even for the early days of the Spectrum, but what it lacks in graphical depth it certainly makes up for in its addictive qualities.

The story, for want of a better word, has *Jumping Jack* reciting a four verse limerick. Unfortunately, though, he won't tell you it unless you guide him to the top of the screen. This, as you can imagine, is harder than it sounds, as each stage comprises of eight layers of floors, which have to be jumped up to in order to reach the top.

To jump from one layer to the next you'll need to wait for a gap in the floor of the layer above, but the gaps move across the screen and up and down the floors. For example, the first level has two moving gaps in the floors: the gap that moves from left to right travels up through the layers to each floor, while the gap moving from right to left travels down through the floors.

What you have to do, therefore, is time the jumps so Jack can move up the floors to reach the top without falling back down through a gap in the floor he's currently on.

It's certainly a tricky game to master. Thankfully, though, you don't lose any lives unless you fall back through the floors and end up at the starting point. The problem,

however, is that the action and the gaps speed up considerably as each stage is complete, and you can soon find yourself running from one end of the floor to the next while being chased by a gap that will drop you to the floor below. If you do fall then you have a few seconds of being dazed before getting back to your feet; in the meantime, the gaps are rapidly approaching.

History

Developed in 1983 by Albert and Stuart Ball, both of whom worked on *Masterspy* and *Rapsallion*, *Jumping Jack* was and released by Imagine Software. It was first available for the 16K version of the ZX Spectrum, but later re-released for the 48K, although there wasn't any improvement on the graphics, sound or overall gameplay.

Interestingly, *Jumping Jack* was released for the Atari 800XL and Dragon 32 machines too, but the name was changed to *Atari Leggit!* and Jack was known as Leaping Lenny.

The Ballad of Jumping Jack, the limerick you unfold as you progress, was identical across the versions. And in case you're interested, it goes like this:

*A daring explorer named Jack
Once found a peculiar track
There were dangers galore
Even holes in the floor
So he kept falling flat on his back*

Did You Know?

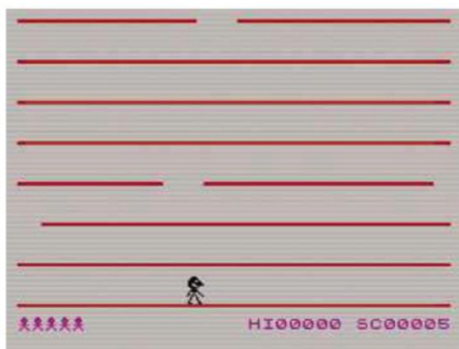
- If you want infinite lives, Poke 30094 with 182
- The final level has 20 hazards: witches, trains, ghosts, dinosaurs, cars, snakes, planes, something that looks like a stuffed olive and many more
- Steve Blower did the tape design and illustration for all versions of the game
- Quite similar to *Dare Devil Dennis* on the BBC Micro

*Quite soon he got used to the place
He could jump to escape from the chase
But without careful thought
His leaps came to nought
And he left with a much wider face*

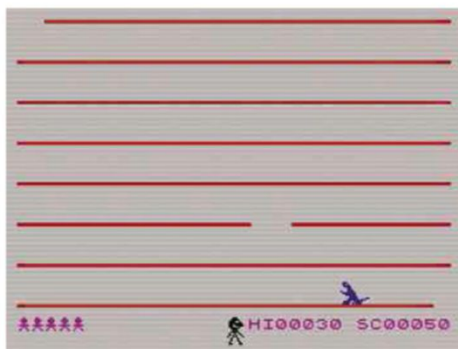
*Things seemed just as bad as could be
Hostile faces were all Jack could see
He tried to stay calm
And to come to no harm
But more often got squashed like a flea*

*By now Jack was in a great flap
He felt like a rat in a trap
If only he'd guessed
That he could soon rest
After jumping the very last gap - WELL DONE.*

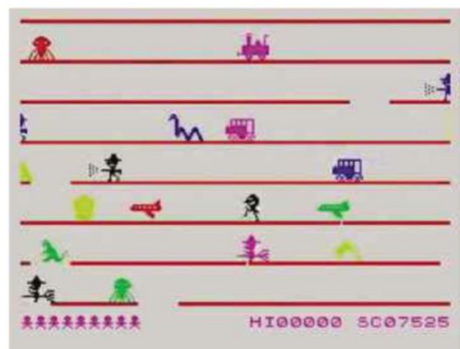
So now you know. **mm**



▲ The first stage seems easy enough, just time the jumps and away you go



▲ Things soon begin to get a little harder, with dinosaurs making an appearance



▲ By stage 20, should you get that far, you're likely to be foaming at the mouth

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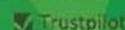
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CHERRY 



Best new Christmas gadgets

Stuck for Christmas present ideas, or don't know what to ask for yourself? Then feast your eyes on these eight innovative gift ideas...



CHERRY MX Board 3.0

www.amazon.co.uk
£64.00

The CHERRY MX Board 3.0 offers a perfect introduction to mechanical keyboards, utilising Red, Linear MX switches under each key. The keyboard design is low profile and simplistic, yet robust and hard wearing, with laser-etched, wear-resistant keycaps and individual keys tested to 50 million operations. 14 key rollover, Win-Key Lock and anti-ghosting technology, coupled with a removable USB cable make this an ideal gaming keyboard, but it's perfect for both home and office use.

CHERRY 

CHERRY DW 5100 Board

www.amazon.co.uk
£30.00

Break free from wires! The CHERRY DW-5100 is a stylish and comfortable keyboard and mouse set, using 24GHz technology for an interference free, 5m range. The mouse has a switchable 1000/1750-dpi resolution for fast desktop movement, 5 programmable buttons and a rubber side-grip for added comfort. This ergonomically designed mouse also has batteries that will last for up to 2 years between changes. The keyboard is a low-profile design with 10 programmable hot keys and an on/off switch to help conserve power. Supplied with a nanoUSB receiver, the set is simply plug and play with no additional software required.



CHERRY 

Promotional feature

mydlink Home SMART Home HD Starter Kit (DCH-100KT)

www.dlink-direct.co.uk
£147.98 including VAT*

This clever little smart home kit lets you set, control, monitor and automate your home from anywhere. So whether you're switching Christmas tree lights on/off remotely or keeping an eye on things while at social gatherings this festive season – you're in control of your home and possessions, wherever you are, giving you peace of mind.

The mydlink™ Home smartphone and tablet app is the command centre for the D-Link range of smart home technology devices. There's no better time of year to discover mydlink Home – smart technology working together for a safer, more interactive home.

*November price list This clever little starter kit lets you set, control, monitor and automate your home from anywhere.



D-Link

CHERRY MX Board 6.0

www.amazon.co.uk
£142.00

With a solid aluminium case, magnetic quick-snap wrist rest and bright red backlighting, the CHERRY MX Board 6.0 is certainly striking to say the least, but it also hides some incredible features. Backlighting can be adjusted to 100 levels on the Red CHERRY MX's linear switches to find the right intensity, there is full 'N' key rollover off all 109 keys, as well as full anti-ghosting technology and Win-Key Lock. A braided USB cable provides simple plug-and-play connection. Its secret ingredient, though, is the exclusive RK technology, providing analogue processing and the fastest response time of just 1ms, just to give you the edge over the competition.

CHERRY

PORT Designs Slim emergency battery 5000mAh

www.northamber.com
£29.99

The POCKET POWERBANK BATTERY 5000mAh by Port Designs "Designed in Paris" provides you with emergency charge for your smartphone for at least 2 full charges and comes with a 2-year warranty! Charge your smartphone or any other USB rechargeable device on the go and this slimline device comes pre-charged and ready to use. Part of the Port Connect range of mobile accessories that are designed to enable users in both the work place and during recreational time!

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- ON/OFF button
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- Output Voltage: 5V
- Output Current: 2.1A



PORT Designs Solar Power Bank 8000mAh

www.northamber.com
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Urbanears Plattan ADV Wireless

www.currys.co.uk
£80

Move around freely and listen to music without the hassle of cables. Plattan ADV Wireless has all the controls you need on its swipe interface. Pair up with Bluetooth and enjoy up to 14 hours of playtime on a single charge. Includes a washable headband and collapsible structure for easy portability.



Component Watch

You don't need to spend big to get decent audio quality...

This week in Component Watch, we're looking at budget headphones and headsets. Whether you want a cheap pair for listening to music or something to give your PC the same communication capabilities as your console, this selection of deals should allow you to do it without spending too much!

Deal 1: Sony MDR-ZX110
RRP: £19.99 / Deal Price: £12.23

Available in either white or pink, these foldable headphones from Sony are an ideal portable pair. They fold down small, have a minimalist but stylish design, and a 1.2m cord means there's no worry about reaching your phone but that you won't find yourself tangled up either. Gold-plated contacts and 30mm drivers ensure an excellent sound too. They aren't what you'd call feature-packed, but they're comfortable, look good, and sound good. Not bad for £12.

Where to get it: Transparent – bit.ly/2gUreIH



Deal 2: Trust GXT10
RRP: £24.99 / Deal Price: £13.37

The Trust GXT10 is a gaming headset by Trust which only costs a little more than the Sony headphones, but incorporates a lot more. So in addition to the headphones, you get a microphone for voice chat and an inline volume control – and while it's not foldable or as stylish-looking as the last pair, the fact that you can do more with it is probably enough to make it worth checking out.

Where to get it: Rapid Electronics – bit.ly/2gUrhnl



Deal 3: Microsoft LifeChat LX-3000
RRP: £29.99 / Deal Price: £15.88

Microsoft's PC peripherals have always been solid stuff, and the LifeChat LX-3000 headset is no different. It connects over USB for fully digital, crystal-clear sound, and has a noise-cancelling

microphone to ensure that you get clean input as well as output. A six-foot cable with in-line volume and additional on-unit voice call controls mean it's easy to control your experience without having to be near a keyboard or mouse. Not bad for the money, but when you aren't paying RRP it gets even better.

Where to get it: CCL Online – bit.ly/2hh1RBB



Deal 4: Corsair Raptor HS30
RRP: £32.99 / Deal Price: £28.98

The Corsair Raptor is a high-end gaming headset with large 40mm neodymium drivers for a clear and robust sound. The noise-cancelling microphone screens out background noise and is fully adjustable, while the closed-back earpads keep sound in without compromising on comfort. Inline controls give you the ability to change the volume or mute the audio instantly. Finally, it's compatible with Mac, PC and PS4, and there's an adaptor available if you want to use it with the Xbox as well.

Where to get it: Scan – bit.ly/2gaSljo



Deal 5: SteelSeries Siberia P100
RRP: £37 / Deal Price: £28.99

SteelSeries have a great gaming pedigree, but that doesn't mean their hardware isn't general purpose. The SteelSeries Siberia headphones are comfortable and sturdy, but relaxed and lightweight. Their mesh padding allows heat to dissipate so your ears don't get too hot, and the onboard mic is sensitive and clear despite being invisibly embedded inside the unit itself. Its USB connection is compatible with the PS4 and it also has built-in LEDs for a classy appearance. Not much to hate here.

Where to get it: Zavvi – bit.ly/2h6C1zP



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Clancy, 21 August

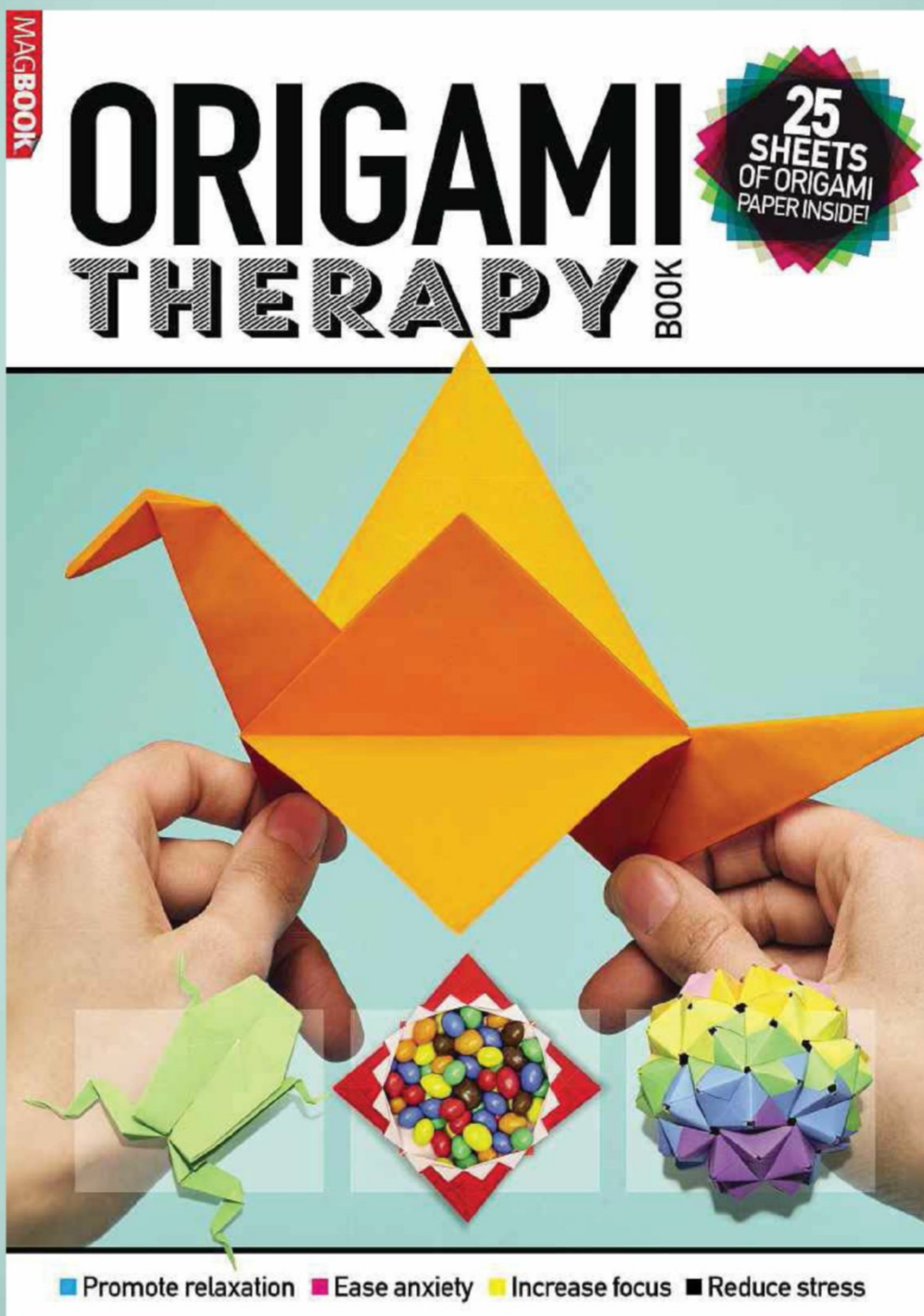
“I’m loving my new ride. I would recommend this service to anyone”



Tatiana, 8 September

Time to relax!

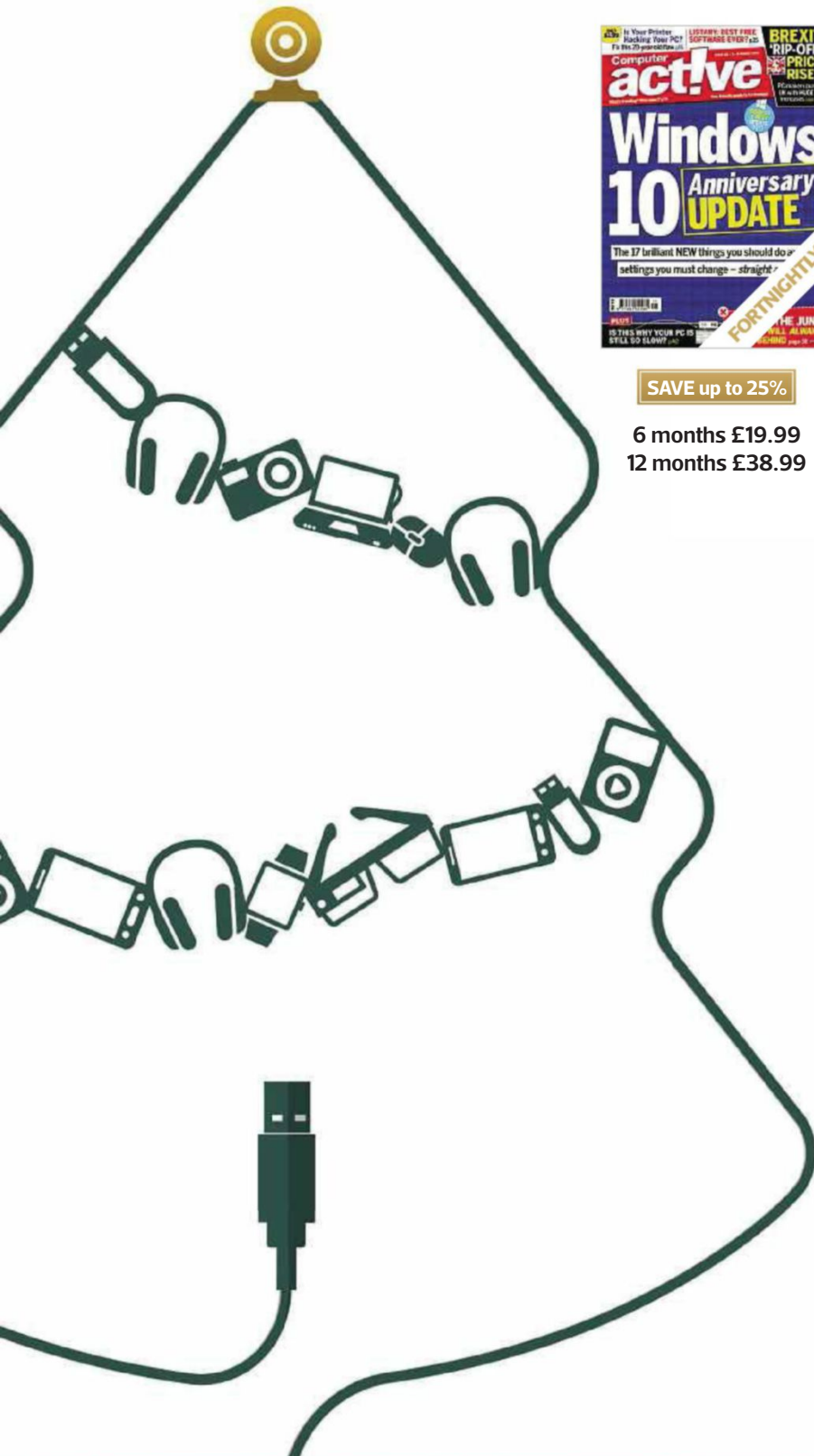
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Offline Downloads Land On Netflix

Company goes back on previous word

Listen Up

Edifier launches THX-certified speaker system

Audio electronics 'innovator' Edifier has released its Luna E 2.1 THX home speaker system, solidifying the firm's THX partnership.

The Luna E 2.1 THX has a signal range of 300 feet and Bluetooth 4.0 connectivity to "take control of your whole house soundscape". The system comes with a remote with touch-

sensitive controls that puts a 5.8G 100-watt built-in subwoofer at your fingertips while the system overall products a 174W power output.

Optical/coaxial and a 3.5mm auxiliary input are included for the £399.99 price point and as well as the classic black colour you can see here, this is also available in Edifier's signature red. Read more on this at www.edifier.com.



Uber Buys AI Start-Up

Look to automated future

Uber has acquired an AI start-up based in New York in a bid to speed up progress in its self-driving cars.

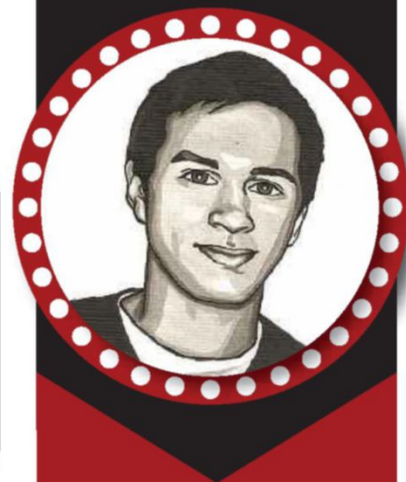
We don't know how much the

acquisition cost but it will mean an additional 15 specialist researchers forming a new division, Uber AI Labs, which will work on such things as improving traffic predictions and even working on flying cars, according to the BBC. Wow – where we're going, we don't need roads.

It's worth noting that Uber actually lost over \$2bn last year, attributed to the firm's rampant growth. This acquisition is hardly going to help it to keep its costs in check but the company is clearly prepared to carry on progressing. It does have a new rival in the self-driving field too...

Having previously stated that it wouldn't be interested in providing an option to download and watch shows and films offline, Netflix has now decided that it might be a good idea after all.

Many of its rivals already allow for this, of course, and it's probably in part a reaction to that which has led to the change of heart. The content covered by this is limited at this stage with only some of its own original content programming being made available for downloading although the plan is to widen this service out to more content further down the line.



It's Beginning To Look A Lot Like Christmas...

At Bletchley...

Christmas just wouldn't be Christmas without obsessing over technology from our past. Whether it's fierce pub debate about the best console of all time or reminiscing with family members about the software and hardware Santa has brought you down the years, computing is as much a part of Christmas as turkey and cranberry sauce.

Now you can keep that festive spirit going between Christmas and the New Year

with a family visit to the National Museum of Computing at Bletchley Park. There is something to entertain everyone at its Christmas Bytes event every afternoon from 27th to 30th December where you can expect to be greeted by talking robot head OhBot, and you can then go in to discover games from Christmas past, present and future, with a try on the Oculus Rift if you're lucky.

There's plenty more to do and if you are going download the Gamar app beforehand for the Augmented Reality museum trail. Read more at www.tnmoc.org.

As many of will already know by now, the next issue of *Micro Mart* is to be the last ever. Unfortunately, like so many magazines in recent years, we just haven't been able to keep going in the age of the internet. And things haven't been made easier by the decline in traditional X86-based computing, outlined by Mark Pickavance this week.

We're still here for now, though, and because this issue is at the end of the year, as usual it will run for two weeks. That means the next (and last) time you'll see us on shelves will be on December 29th.

So I'd just like to take this opportunity to wish you all a merry Christmas. Join us back here in two weeks, and let's give this wonderful magazine the send off it deserves.

In the meantime, if you have any memories of *Micro Mart* that you'd like to share, email us at letters@micromart.uk and we'll try to get as many of your letters as we can before we finally turn out the lights.

Anthony

Meanwhile... On The Internet...

If you follow @micro_mart on Twitter, or our Facebook page, you will have heard the news that, as of December 29th, *Micro Mart* – and thus also our little corner of it – will cease to exist... Our metabolic processes will be history... We'll be off the twig, kicking the bucket, shuffling off the mortal coil, running down the curtain, and joining the bleedin' choir invisible (tinyurl.com/MMnet44a)! We will be an ex-column. It was fun while it lasted, though. Well, it was when we started...

The weird thing about writing something like this week-in-week-out is that, as stories appear, die away, and sometimes reemerge, the shape and tone of the column shifts little-by-little over time. Doing it for any amount of time also means you become more immersed in the world you're writing about, less wide eyed and more cynical, of course.

When we started this, for example, what the internet had collectively dubbed memes (tinyurl.com/MMnet44b) seemed like they were an increasingly powerful humorous force, at least in their 'Advice Animal' form (tinyurl.com/MMnet44c), Reddit was an ever-growing, increasingly powerful driver of social media content, *Gangnam Style* was still novel, and the patter of the internet seemed to generally be a quirky, fun alternative to the 'real' world.

You may remember that we, for a while, used to dedicate a corner of this page to 'meme watching', picking out the new, funny thing that had come along in the last week or so and spread virally. Quickly, though, memes became almost-omnipresent (tinyurl.com/MMnet44d), and as much a driver of conversation and political discourse online as a wry commentary on it and the world in general. Thus singling them out became less necessary, and less funny. Now, memes appear, disappear, and reappear at an alarming rate, and they've been heavily co-opted by some of the more worrying sections of the online community (tinyurl.com/MMnet44e).

While previously, some of the less savoury thinkers of the online world frequented 4Chan, and – save for a few notable times they raised their heads above the parapet (tinyurl.com/MMnet44f) – could largely be ignored if you stayed away from its boards. However, as that niche has grown up, and grown in influence (tinyurl.com/MMnet44g), it has struck out into the wider world, seemingly infecting it like a virus. Suddenly, the tone appeared to shift and the online world got a whole lot more serious. What had previously seemed like a nice escape from the ills of the world outside, came to feel like something more akin to a scary distillation of many of its less-pleasant elements. You may have noticed our mood shift too.

If you want our opinion (even if you don't, you're going to get it anyway, because who's going to fire us now?) this can

be traced back to three events: the leaking of the NSA digital playbook by Edward Snowden (tinyurl.com/MMnet44h), the release of a tranche of celebrity photos stolen from various iCloud accounts in 2014 (aka The Fapping, aka Celebgate) and the whole Gamergate thing that came not long after (tinyurl.com/MMnet44i).

With them came far more understanding of the sheer extent that our lives were being, monitored, tracked and spied upon online – mass surveillance was real, and we were all wrapped up in it – trolls seemed to truly come to the fore and sharpen their knives, and we became aware about how insecure the digital world left our personal information, and consequently a degree more wary about who had access to it and who we shared it with.

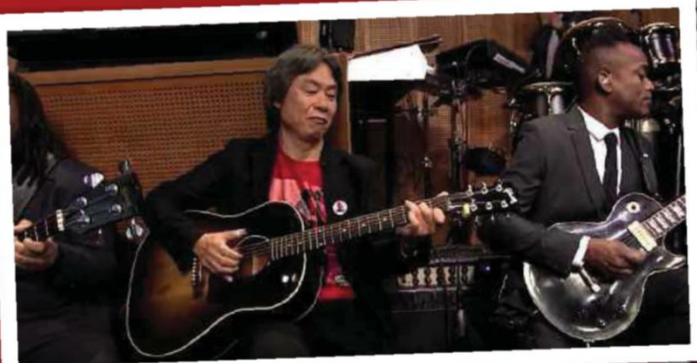
You could argue that all these things had been effecting certain sections of the online community for years, and you'd be right (or, as John Oliver so succinctly put it: "if you're thinking 'well, that doesn't seem like that great a problem', congratulations on your white penis... Because if you have one of those, you probably have a very different experience of the internet"). However, in a short time, virtually everyone who frequented the online world (i.e. billions of people) suddenly got a massive dose of reality. The scales collectively fell from the world's eyes, it seemed.

Now, of course, Twitter is the chosen megaphone of the next leader of the free world (insert your own dystopian joke here, my friends), and we live in a world where a 16-year old can make unfounded accusations and quickly have his thoughts repeated by the next president as fact (tinyurl.com/MMnet44j), Fake News (aka bold-face lies) on Facebook is cited as influential in an election, a Reddit conspiracy theory can lead to shooting (tinyurl.com/MMnet44k), after getting rumbled regarding the extent of its questionable spying on us the UK government simply spelled-out all its security forces' dodgy practices and wishlist in the IP Bill and faced little opposition (tinyurl.com/MMnet44l), and where libel laws here (tinyurl.com/MMnet44m) and in the US (tinyurl.com/MMnet44n) are under the kosh in ways that could kill off investigative journalism (tinyurl.com/MMnet44o). Also, sadly, due to the rise of the internet, the business model that's financially supported magazines like ours has been ripped to pieces slowly over the last 15 years to the point where it's not viable for us to carry on, it would seem. Don't feel sorry for *Micro Mart* or Team Meanwhile, though, at least we won't have to report on it all happening in slow motion anymore.

We'd just like to ask you to be excellent to each other in the future, okay (tinyurl.com/MMnet44p)? And, of course, keep 'em peeled... (tinyurl.com/MMnet44q).

.AVWhy..?

If we've learned one thing in our time being obsessed with computers, it's this: no one is as cool as Miyamoyo-san. You may think you are, but you aren't. You didn't invent *Donkey Kong*, *Mario*, *Zelda*, or *Star Fox*; you didn't appear as a puppet alongside the late, great Satoru Iwata (tinyurl.com/MMnet44r), and you certainly have not played the theme tune synonymous with your greatest creation with peerless hip-hop group The Roots. See, told ya... (tinyurl.com/MMnet44s)



Caption Competition



"It beats an Apple"

Here are your best entries for 1442's Caption Competition...

- **doctoryorkie:** "What's orange and sounds like a parrot?"
- **fallguy:** "Oh Gordon Bennett, I'm using the carrot, not the mic"
- **BullStuff:** "Looking for vegan.co.uk."
- **Thomas Turnbull:** "I went to the Black Friday sale and all I bought was a carrot."
- **doctoryorkie:** "A carrot a day keeps the pretentious away."
- **JayCeeDee:** "Temporary fix for a malfunctioning backlit led screen."
- **BullStuff:** "I have created the vegetarian stylus!"
- **JayCeeDee:** "Touch screen not working? Your choice - the carrot or the stick!?!"
- **fallguy:** "I plugged it in but they can't hear me."
- **pesukarhu:** "XXXXXXXX --- CENSORED! --- XXXXXXXX"
- **Mad Malc is back:** "How to remotely get a donkey to follow someone with a mobile."
- **BullStuff:** "This is the reward. Boot this time, or I use the stick!"
- **Peter Hopkins:** "Siri you're telling me to stick this where?"
- **Thomas Turnbull:** "Well I've got the carrot, all I need now is the stick and I can rule the world."
- **Terry Martin:** "Trying to open a What's Up .doc file."
- **Leigh Spriggs:** "Trying to root Android with a root vegetable."

The winner, though, was Doctoryorkie with the simple, almost timeless, "It beats an apple."

Dear readers. If you've read Tony's column this week (p37), you will already know that, sadly, we only have one more *Micro Mart* to come after this. Yes, issue 1445 will be the last *MM* ever... As such, there's not a lot of point having a caption pic for an issue that's not going to exist, we suppose. As such, the pic from 1443 will your final chance to take part in our prizeless passtime. You can see the pic at forum.micromart.co.uk/Topic552674.aspx, if you'd like to give it one last go – but you'll need to get your entry into caption@micromart.co.uk or on the forum thread before Friday, December 16th. Good luck!

Apple Interested In Autonomous Cars

Nobody is surprised

Apple has written to US transport regulator the National Highway Traffic Safety Administration to confirm its interest in self-driving cars, stating that it was "excited about the potential of automated systems in many areas, including transportation".

It's not exactly a massive surprise, let's be honest, but by putting it out there so publicly Apple has rather laid its cards out on the table, which could

have its rivals take note given Apple's brand value. In the letter, Apple calls for greater information sharing among companies working on autonomous vehicle projects and the promotion of fair treatment of both established manufacturers and new entrants.

Beyond this letter there is no real detail into Apple's plans, known as Project Titan, so we still don't know what's really going on behind closed garage doors.

Avoid Fake Apple Chargers

Trading Standards warns consumers

Trading Standards has handed out a big warning to consumers that fake chargers for Apple products could prove potentially fatal.

Almost all of the fake chargers gathered in an investigation, 99% of them, failed a basic safety test with just three of 400 fake chargers found to have

sufficient "isolation" to protect users against electric shock. As part of a second operation targeting charity shops, antique dealers and second-hand shops, 15% of used electrical goods were also found to be non-compliant.

The message from all of this is clear: only use genuine Apple chargers.

Snippets!

Forgotten Phones Gather Dust

British mobile company Talkmobile has carried out new research that has found that nearly 15 million households in the UK have old technology lying around the home, all forgotten.

The study of just over 2,000 households in the UK showed that mobile phones were the most likely technology to be lying around unused and as most phone models typically sell for around a tenner more online – some selling for much more – there's money in them there homes.

Car Thief Locks Himself In

BMW's remote locking technology has been used to help police in America ensnare a thief.

Seattle Police wrote a blog post on how a car thief stole a BMW vehicle and was subsequently tracked down and locked inside using the company's remote locking technology after the car's owner contacted them about the theft.

How did he get locked inside in the first place? Well, he fell asleep behind the wheel which gave BMW the time they needed to lock him in. So a win for technology and a big fat loss for car crime.

Tech Team-Up To Curb Terrorism

Facebook, Microsoft, Twitter and YouTube have announced a partnership to "help curb the spread of terrorist content online".

The companies are going to create a shared industry database of "hashes" – described by the group's release as kind of "digital fingerprints" – for violent terrorist imagery, terrorist recruitment videos or images that have been removed from the services in order to help them better identify potential terrorist content on each of the platforms.

Apple Watch Wanes?

Market report suggests sales drop off

IDC has released its latest Worldwide Quarterly Wearable Device Tracker, which sounds like a riveting read. The headline figure to take from the report, however, is interesting as it would seem that take-up of the Apple Watch has dipped significantly.

In the third quarter of the year, the Apple Watch range sold 1.1m units in total which amounts to 2.8m fewer sales than in the same quarter in 2015. Apple's share of the market was impacted as a result, according to IDC, with the Watch accounting for just 4.9% of the market, down from 17.5% over the same period last year.

IDC researchers are blaming Apple's more basic wearables for the company's sales woes. Of 23m wearable devices shipped in the third quarter, 85% were "basic wearables" – fitness devices, essentially – with FitBit leading the way. In response, Tim Cook told Reuters that things are actually fine and that sales of the Apple Watch to consumers set a record during the first week of the traditional

holiday period in the US. Of course, one good week doesn't mean everything is rosy so Apple will be hoping for better overall sales news come the end of the year.



Nokia Coming Back Next Year

No, really

Welcome back, Nokia. At some point early next year the brand name will once again appear on smartphones as a new range has been planned by a start-up in Finland, HMD global Oy. The start-up has bought the Nokia licence to relive the brand's former glory days, with a ten-year deal announced.

The Nokia-branded Android phones will be going up against the big brands and, like the Nokia handsets of old, these devices will be designed to be simple, reliable and easy-to-use. Foxconn will

actually manufacture the phones and the company behind this brand relaunch is made up of former Nokia employees and others from the mobile phone industry.

For the UK market, Nokia's brand name might have some resonance with consumers of an elderly persuasion but it will likely remain little more than a curiosity for the bulk of the buying public. For this reason, should HMD global Oy want to really make a success of this they are going to have to come up with some decent hardware to bring enough people on board.

Note 7 Design Caused Battery Blow-Ups

Blog post damning of Samsung handsets

As the dust has just about settled over the exploding Galaxy Note 7 handsets, a team of hardware engineers has now announced that an “aggressive design” could have been at fault for its exploding Galaxy Note 7 handsets.

The team at Instrumental said that as the phone was so slim it compressed the lithium battery “during normal operations”, which is considered an issue as it’s recommended that there is

a space left between a battery and a phone’s shell.

The engineers at went as far as saying that Samsung shipped a dangerous device and that the company went down this route because of its desire to innovate and be competitive against rivals.



Visa Cards Easy To Crack

Mastercard more secure

Researchers at Newcastle University have written how fraudsters can guess Visa credit card numbers in just six seconds per attempt, blaming security gaps in Visa’s network.

Brute force attacks to guess those credit card

numbers are so successful with Visa as its security systems don’t detect brute force attacks made across multiple websites. This is worrying news for those of us who own Visa credit cards – and that’s a lot of us – but Mastercard owners should feel happier than its security systems seem tougher.

Computer Pens Christmas Song

AI-written ditty probably won’t top charts

As far as AI-related projects go, this is a fun one.

According to The Guardian, scientists have fed a Christmas scene on a photograph into a computer and asked it to come up with a song based on that photo. The computer duly analysed the photo, came up with some lyrics and then “sang” those words to music that it also composed itself. This is the brainchild of people from the University of Toronto with the “neural karaoke” project

apparently able to take any digital photo and turn that into a song.

The team at the university has also now taught the computer program how to dance, looking at an hour of footage from Just Dance and then tracking poses to learn some funky moves that a digital stick man can then bust out. Any practical uses for this? Well no, no there are not. But if someone can have a bit of fun while advancing artificial intelligence a little further, isn’t that reason enough to carry on?

Amazon Revolutionises Shopping

Look, no queues!

Those crazy cats at Amazon have solved the last great bugbear of retail shopping: queues.

The company has announced that it’s been working on its Just Walk Out shopping concept for a retail outlet that doesn’t need a checkout. Customers will enter the Amazon Go store, with Seattle selected for the first location in early 2017, scanning an Amazon app on their way in. Any products taken off shelves will be added to the

app’s virtual shopping cart and consumers can then simply take the products away from the store without checking out and they will be charged on their Amazon account on leaving.

The technology behind this is a combination of computer vision, sensors and deep learning algorithms, similar to those used in self-driving vehicles, and it’s all impressive-sounding stuff. One slight worry, though – is human interaction going to become a thing of the past?



Asus Transformer 3 Pro T303UA

Finally, a convertible to beat the Microsoft Surface Pro 4

DETAILS

- Price: £1399.99
- Manufacturer: Asus
- Website: goo.gl/aBmmR5
- Requirements: MS/Windows account, HDMI cable for external monitor viewing



▲ There's a level of simple, but effective design to it, but it can easily keep up with you

Microsoft's Surface Pro 4 was a surprising hit when it was released last year. In spite of the grief the company has received for previous Surface models and its operating systems, many users and pundits alike took a shine to the sleek and reasonably sprightly Pro 4.

It's little wonder, then, that manufacturers started to take a leaf out of MS's book. Indeed, there are a number of convertible notebook/tablets that ape the Surface Pro 4's features. Sadly, some aren't really worth the expense, but Asus may be on to a winner with its new Transformer 3 Pro.

On the surface (no pun intended), the Transformer 3 Pro is near identical to Microsoft's offering. However, within its sleek 298 x 210 x 8.35mm tablet chassis Asus has managed

to cram in some pretty decent specs.

You'll find a choice of either an Intel Core i5-6200U or an Intel i7-6500U (reviewed here) running at 2.59GHz. There's 8GB of LPDDR3 2133MHz memory and a hefty 512GB SK Hynix M.2 SSD, with Windows 10 Home 64-bit.

Connectivity is excellent, with a USB 3.1 Type-C Thunderbolt port, a full-sized USB 3.0 port, an HDMI port, combo audio jack and a micro-SD card slot. Naturally, there's also 802.11 AC wi-fi, with WIDI support and Bluetooth 4.1, alongside a 8MP front camera and rear 13MP camera.

Its design is simple but quite effective. It lacks some of the

bells and whistles we've seen with other convertibles, but it works well, and the aluminium magnesium alloy chassis is certainly a stylish feature. The kickstand too is sturdy and continues the metallic alloy both on and under it.

The keyboard section looks a little plain to begin with, but once it's connected, via a magnetic strip, the backlit feature kicks in, and you'll soon come to appreciate the comfortable typing position and nicely spaced keys. Additionally, the trackpad is responsive and equally well constructed.

The display is a key feature of the Transformer 3 Pro and probably its biggest selling point. The 12.6" LED WQHD+ display manages a maximum resolution of 2880 x 1920, and it's a joy to behold. The colours are vibrant, and images have a neat, crisp look to them that photo editors will certainly be pleased with. Furthermore, the included stylus is responsive and surprisingly accurate. Digital artistry isn't our forte, but even we managed to draw something on the screen as well as we would with a traditional pen and paper.

The performance of the Transformer 3 Pro is far better

than we imagined. While it won't be able to keep up with gaming or 4K video editing, there's more than enough weight behind the processor and memory to keep up with everyday tasks, and the M.2 SSD is nippy enough to keep Windows 10 and any installed programs zipping along without any hint of lag.

There's plenty to like about the Asus Transformer 3 Pro. It's quick, the display is great, and it's quite a stylish tablet and notepad convertible. It's priced more than the MS Surface Pro 4, at £1399.99, but it's a far better convertible and one that's definitely worth a look.

mm David Hayward

An excellent convertible that'll keep any user happy



▲ The Asus Transformer 3 Pro is certainly a stylish-looking convertible



Asus C202S Chromebook

Designed for education and ready for anything

DETAILS

- Price: £199.99
- Manufacturer: Asus
- Website: goo.gl/pDmuUe
- Requirements: Google account

We've already had a look at a couple of Asus's new C-series

Chromebooks in Micro Mart. The C200 and C201 were particularly impressive, combining style and performance. However, it's now time to sample a new C-series model, the C202S.

The C202S is squarely aimed at students, regardless of whether they're in junior school, high school or higher education. This is a sturdy and robust Chromebook that has been tested and surpassed a collection of durability inspections. The gauntlet of tests it passed allow it to be dropped from a height of 3.9 feet, have 66cc of liquid spilled over the keyboard, and an improved hinge that not only opens to 180 degrees, so it can be laid flat for viewing, but it's also able to withstand little hands being a tad rough with it.

The specifications isn't too bad either, with a 1.6GHz Intel Celeron N3060 processor with a turbo speed of 2.48GHz, 4GB of LPDDR3 memory and 16GB of eMMC flash storage.

Connectivity consists of a pair of USB 3.0 ports, HDMI and SD card reader, combo audio port, HD webcam, 802.11 ac wi-fi and Bluetooth 4.0. It's not a huge amount, but it's sufficient for the 294 x



▲ *The toughened and rubberised finish of the Asus C202S makes it cable of withstanding the classroom*



▲ *There's plenty to like about this little Chromebook*

200 x 22.5mm dimensions and the use it's designed for.

Being a more classroom-led device, the Asus C202S isn't trying to win any style awards. It's not as sleek as the C201, but it does have its benefits. The edges and corners are

made from a nano-molding technology, which protects the C202S from any drops and knocks, and the chassis itself has a textured, rubber-like finish. There are also two rubber feet at the base, which cover most of the width of the

C202S; one of these is raised and designed to allow the user to carry it easily.

The interior design is similarly well thought out too. The keyboard section is large, well spaced out and with 2mm travel on each key. The 11.6" screen is coated in with an anti-glare agent, and although it only has a resolution of 1366 x 768, it's surprisingly clear, colourful and crisp – even in full sunlight.

There are plenty of other robust and student-friendly laptops and netbooks available, and we've seen our fair share of them. But there's something about the C202S that we think pitched it higher than what we've previously reviewed.

The spec and its performance are certainly ample for the classroom or even university students at work, and we liked its drop- and spill-proof design. The display could do with being a little bigger for older students, admittedly, but for younger students it's ideal.

For £199.99, the Asus C202S Chromebook is a great classroom tool for early years and onward.

mm David Hayward

A great little Chromebook at an even better price





DJI Phantom 3 Standard

Mark deploys his own surveillance hardware in the DJI Phantom 3 Standard

DETAILS

- Price: £399 (Argos)
- Manufacturer: DJI
- Website: store.dji.com/
- Requirements: iOS 8.0 or later or Android 4.12 or later phone, boundless enthusiasm



I've wanted a UAV for some time, and even though I was tempted to spend much more, in the end I resisted and plumped for the Phantom 3 Standard edition.

DJI launched the Phantom 3 in 2015, and there are three current versions you can choose: Standard, Professional and Advanced. It's since added Phantom 4 models, the new Mavic Pro and the Inspire 2. But even the Phantom 3 Advanced costs nearly double this, and the Professional is more than a thousand pounds.

That begs the obvious questions of how DJI made the Phantom 3 Standard so cheap, and whether it undermines its usefulness.

The cost cutting has hit two specific areas on the UAV: the drone itself and the controller. Whereas the

“ There's a huge third-party market for parts, should you break yours ”

controller on the Advance and Professional have dual antennas and the ability to connect using Lightbridge technology, on the Standard you get a single stubby

antenna that uses frequencies that realistically only get you out to about 1km before the link starts to break. Since I've had mine, I've found some simple and relatively inexpensive ways to extend that to a mile or more, and under UK rules you are supposed to maintain a visual link with the UAV at all times.

The camera on it can also only record 2.7K video, not 4K, but it's hardly chopped liver when you play it back on a TV. There are also a few limitations about slow motion recording, but you can also get around some of them

using alternative software to the recommended DJI Go app.

And the better drones have some collision avoidance technology, but with this drone it's up to the pilot not to fly into things.

I'd classify almost all the other differences as minor details. As an example, the quick release props are a welcome feature, but as I leave mine attached, it's not a huge deal. Equally, the mount on the

DJI Phantom 3 Standard Features

- Gimbal stabilised 2.7K camera.
- Camera takes 12MP still photos.
- Wi-fi downlink for HD live view.
- GPS for enhanced stability and failsafes.
- Works with DJI GO App for Android / iOS.
- Auto-takeoff / auto return home.
- Up to 25 minutes flying time.
- Intelligent LiPo flight battery.
- Built-In controller battery/usb charging.
- Mobile device holder included.





controller only takes a phone sized screen not a tablet, but you can buy an alternative mount for £10 easily.

If there is a catch it's that buying the drone is just the start of spending, because you'll soon want all manner of extras to enjoy your aircraft even more.

While not an absolute necessity, having some visual feedback from the camera and reference information requires an Android or iOS

device, and you might not want to flatten the battery on your own phone.

And talking of batteries the ones for this drone are pretty expensive. It only comes with one, and even with a decent flight time of 25 minutes, you'll want longer. The official battery costs £124 from DJI, though you can get it cheaper elsewhere or chance third-party batteries.

Incidentally, power problems account for the top

five problems that cause people to crash their drones, in case you wondered.

I ended up buying prop guards, a gimbal protector and a second-hand Nexus 7 2013 to use as a control screen, along with three batteries. All told, I've blown at least another £300 on it.

Out of the box, you get the drone, controller, a set of replacement blades, a charger and a cable to use a phone charger (or PC) to charge the controller. You also get a lovely set of metallic stickers, so you can identify your UAV when it's around others.

There's a huge third-party market for parts, should you break yours or you wish to invest in carbon fibre props or some other enhancement. This aspect and the current price are the major advantages of this not being the latest DJI design.

Even after all that outlay, what do I think of the Phantom 3 Standard? In a word, 'amazing'. I'd love a Mavic Pro or an Inspire 2 but I'd be genuinely terrified of crashing it catastrophically, as most people eventually seem to do with their drones.

With this choice, I've now got a UAV that can film high-quality video, run pre-programmed flight paths taking still images for terrain mapping and a million other uses. And if it crashes, it can be fixed or replaced without it bankrupting me.

I just can't wait to take this on holiday with me and use it to get some video shots that people will be interested to see and not sleep through.

mm Mark Pickavance

An incredible flying mobile video and stills platform



Palit GeForce GTX 1060 StormX 3G

Mark buys a nice video card for all the wrong reasons

DETAILS

- Price: £179.99 (Scan)
- Manufacturer: Palit
- Website: www.palit.com/
- Requirements: x16 PCIe slot, six-pin PCIe power line
- Part no. NE51060015F9-1061F

There's a fine irony in that what pushed me to get a better graphics card isn't gaming but the maths intensive processing of drone-captured images.

The software I'm using can utilise the CUDA cores to accelerate processing, so I decided that I'd get something with a bit more grunt than my lovely Zotac GeForce GTX 960.

The current generation equivalent is the GTX 1060, although, as I rapidly determined, the price range of these is exceptionally wide.



Palit StormX Specification

Memory: GDDR53GB.
Memory Interface: 192bit.
Base GPU Clock: 1506MHz.
Boost Clock: 1708MHz.
Memory Clock: 4000MHz (effective 8000MHz).
CUDA Cores: 1152.
Memory Bandwidth (GB/sec): 192.
Microsoft DirectX: 12 API with feature level 12_1.
OpenGL: 4.5.
Bus Support: PCI-E 3.0 x 16.
Outputs: Dual-Link DVI, HDMI 2.0b, DisplayPort 1.4 x 3.
Maximum Digital Resolution: 7680x4320@60Hz.
Card width: 2 slot.
Board Size: 252mm x 112mm.
Graphics Card Power: 120W.
Minimum Recommended System Power: 400 W.
Supplementary Power Connectors: Six-pin x1.
Accessory: Manual, DVD driver.

For these reasons you can pay as little as £180 for something like the Palit GeForce GTX 1060 StormX 3G or easily £290 for an MSI GeForce GTX 1060 GAMING X 6GB. In explaining that oddity, you need to accept that not all GTX 1060s are made equal. The cheaper ones have half the memory, fewer shaders and texture units, confusingly.

On that basis, why would I want one? Well, having 128 fewer shaders isn't good, but that's less than 10% of the total number in the 6GB design. And while the texture units are equally reduced, critically the ROPs remain

completely untouched.

But the most important aspect of this card that isn't hindered is the memory bandwidth, because while it might only have 3GB of GDDR5 not 6GB like the high-end models, the memory is wired to the same 192-bit bus delivering the same throughput.

On that basis, I quite reasonably theorised that it's possible to find some memory capacity or texture abusing benchmark where the 6GB cards blitzed their smaller cousins. But in the majority of tasks, they'd offer very similar performance, especially doing most of the things that matter.



“ Has almost all the GPU goodies while not breaking the bank ”

Testing this one, I soon realised that in a worst case scenario, this card is about 5% slower than one costing at least another £70 or more.

As an example, the StormX 3G scored 10,673 in 3DMark Fire Strike, whereas on the same Core i7 system, the Zotac GTX 1060 AMP! Edition 6GB scores just 11,233 or 5.2% more points.

It's also worth considering that the AMP! is pre-

overclocked to a 1557 MHz core, whereas the StormX uses stock GPU clock speeds 51MHz slower.

For those curious about how it compares with the Zotac GTX 960 AMP!, that card scored roughly 6,900 in the same test, so the StormX is at least 54% faster.

Therefore, you get substantially better value in this package than you do in the more expensive cards and

substantially more go than the generation it replaced.

But surely there is a downside, not least the missing 3GB of GDDR5 and the 128 shaders? They're less of an issue than the quality of the construction chosen to make this card as cheaply as possible.

As fan shrouds go the one on here is remarkably thin and overly flexible, and it offers so much space around the edges I'm not really sure what purpose it is.

There isn't any reverse-face metal plate to capture heat on top side of the card, and the single 80mm fan seems to work rather hard when you stress out the GPU.

The box also contains nothing other than a driver disc and a small leaflet, although it's hard to imagine what else it needs, as it only uses a single PCIe six-pin power cable and has no multi-GPU SLI connector.

What it does have is HDMI, Dual-Link DVI and no less than three full-size DisplayPort

1.4 outputs, and any four can be used simultaneously.

As a reviewer, I'm not often shocked as to what great value a product offers, but the Palit StormX has almost all the GPU goodies while not breaking the bank.

I did consider the GTX 1050i, but at this price the StormX was irresistible.

mm Mark Pickavance

A powerful video card with a GPU that's ready for VR gaming



iStorage datAshur Personal2 USB Secure Flash Drive



The perfect secure storage solution?

DETAILS

- Price: £39 for 8GB, £79 for 64GB; 32GB version reviewed at £59
- Manufacturer: iStorage
- Website: goo.gl/ci9oun
- Requirements: Any available USB port, OS independent; USB 3.0 for best results



Security and privacy are without a doubt two of the most talked about words in the media today. If it's not something to do with your person, it's the ongoing fight against the Snoopers Charter and its like. However, security and privacy isn't always about the war against a Machiavellian government; often it's simply about keeping information out of the hands of others.

In recent years, there have been far too many reports of people leaving or losing memory sticks, portable hard drives and even laptops where personal information is held. Health records, financial data, addresses, names, telephone numbers, bank account details, company project details... you name it, it's probably been left on a train at some point.

iStorage has for many years now offered a hardware encrypted solution for those who are required to carry around sensitive data with them. The newest addition to the list of already impressive products is the datAshur Personal2, a regular sized USB 3.0 flash drive complete with a

10-digit PIN code.

Available in four different capacities (8GB, 16GB, 32GB and 64GB), this USB 3.0 device is perhaps the most secure device of its kind we've ever used. The PIN code can be configured from seven up to 15 digits to lock the device, together with a military grade XTS-AES 256-bit hardware encryption that encrypts all the data written to the device in real-time.

In addition to the above, the admin can set a read-only option for a user account, limiting the device's contents to stop any accidental overwriting or additional writing, and the device can have a timeout function set from between one to 99 minutes. There's even a brute force detection routine included in the Personal2, whereby ten unsuccessful attempts at accessing the user PIN will result in the device locking and deleting the user PIN, and ten consecutive unsuccessful attempts at the

admin PIN will result in the deleting of both user and admin PINs and the deletion of any data held on the Personal2 device, returning it to a factory default state.

The Personal2 itself measures 83 x 17.4 x 8.6mm and weighs just 20g. One side houses the 10-digit PIN buttons along with a Lock button and three LEDs, indicating locked, unlocked and the state the device is in while the admin programs the PIN codes. The opposite side features either the black plastic casing or, for a small payment, an aluminium plate with your name or company logo laser etched on it.

Operating the Personal2 is very easy: you simply enter the PIN code, either admin or user, and insert it into an available USB port. When you're ready to lock the device and its contents, make sure everything is written and unplug it. The Personal2 will self-lock and will be secured until unlocked. Incidentally, the Personal2 is OS independent and compatible with everything from PCs to printers, scanners, CCTV, medical equipment and even thin clients.

Transfer speeds are surprisingly good too. When used in a USB 3.0 port, the

Personal2 managed 169MB/s read and 107MB/s write with the 8192KB ATTO benchmark. The smaller 4KB benchmark was measured at 27MB/s read and 25MB/s write.

We are remarkably impressed with the iStorage datAshur Personal2. We even like the personal touch with the aluminium plate.

If you're in the business of holding onto mission-critical, sensitive data or you just want a secure storage medium in home, then the Personal2 is the ideal device.

mm David Hayward

Super-secure and with great performance



Asus Transformer Book T101HA

With too many 2-in-1 devices to choose from, here's one that may stand out

DETAILS

- Price: £249.99
- Manufacturer: Asus
- Website: goo.gl/bkjFCu
- Requirements: Windows/Microsoft

Asus has proved itself to be one of the industry leaders when it comes to convertible and detachable tablets and notebooks. There's already a decent range of 2-in-1 devices available in the company's stock, and it has recently added to that with the launch of the Transformer Book T101HA.

The T101HA is a fine example of mixing a tablet with a notebook. Its Intel Cherry Trail quad-core Z8350 processor runs at 1.4GHz with a burst frequency of 1.9GHz, and it manages to drive the 10.1" T101HA along at a decent pace. The 4GB of LPDDR3 is plenty for most tasks, and there's a choice of either 32, 64 or 128GB eMMC flash storage fitted with a copy of Windows 10 64-bit pre-installed.

Connectivity is good too, with the tablet section housing a micro-HDMI port, a full-sized USB 2.0 port and a further micro-USB port, micro-SD card slot and a microphone/headphone port. Furthermore, there's a 2MP front camera on the tablet section.

Obviously, you get the usual 802.11ac wi-fi and Bluetooth 4.1 as well, but all this is neatly fitted into a selection of metallic coloured, anodised aluminium cases of both the tablet and keyboard/base sections.

The design of the T101HA works well, though. The tablet



▲ The Asus Transformer Book T101HA is certainly stylish



▲ It has its niggles, but overall it's a good 2-in-1 device

section pops on and off the base with a little tug to break the magnetic strip that keeps everything together. This makes the task of separating and bringing the two together faster and more efficient, and without possibility of dropping or over-forcing two connected sections to marry up. The 580g tablet section and 500g base combined are still light enough to carry on your person, and since it only measures 261 x 175 x 9mm with 10mm for the thickness of the base, it's not a bad size either.

The keyboard section has the keys spread right to the edges, within a few millimetres of the limits of the base. This gives just enough room for the keys to be reasonably well-spaced apart to make for a comfortable typing position. However, it wasn't the most responsive we've seen and used. Another minor niggle we had was the trackpad. While okay, we found it a little too small for our liking, although that is limited by the size of the T101HA and, like the keyboard, not quite as responsive as we would have expected.

In terms of performance, the T101HA did reasonably well. In Geekbench 3, it managed a combined processor score of 2,943 – not bad and better than some of the other convertibles we've seen in the past.

While it won't play *GTA V*, the T101HA does an admirable job of navigating Windows 10, its apps and the usual array of word processing, web browsing and media viewing. It's predominantly a work/light play device, and it fits the role suitably without trying to punch above its weight.

The screen has a maximum resolution of 1280 x 800, which isn't amazing, but it manages to produce a clear IPS-like image that's easy on the eyes and looks good from a multitude of angles thanks to the use of both the Asus Splendid and Wide View Technologies.

The Asus Transformer Book T101HA is a decent little 10.1" convertible. It's well priced, and it does a good job as a work and social tablet/notebook, plus the battery lasts for around ten hours of office-type use too.

mm David Hayward

A decent 2-in-1, with a good battery life



GROUP TEST

Rescue Discs

Despite our best efforts in keeping our PCs virus and problem free, there occasionally comes a time when something can go drastically wrong.

If we had a pound for every time one of our PCs suddenly stopped booting or we messed up some of the files, folders and even the Master Boot Record, we'd be rivalling the Rockefeller family for wealth.

Here are six rescue discs that'll help you bring your PC back to life after it has seemingly died.

Rescue Discs

Avira Rescue System

DETAILS

- Free
- Manufacturer: Avira
- Website: goo.gl/X7gKe0
- Requirements: 1GB RAM, 700MHz CPU, internet connection

Formally known as Avira AntiVir Rescue, the now entitled Avira Rescue System enjoys a long history in recovery media. Indeed, 526,548,560 global installations, at the time of writing, is pretty impressive, but does it still have what it takes to help you out of digital bind?

The Avira Rescue System is a Linux, Ubuntu-based, bootable ISO image (also available as an EXE), that can scan, detect and remove all manner of malware infected, non-bootable systems.

From within the main customized Unity desktop you can open a browser, file manager, GParted, Terminal, view the system settings, enter the recycle bin, view the installed programs in the product and enter the Avira Rescue System.

The Avira Rescue system contains a number of external programs to help rescue the host system. There's a Windows registry editor, a virus scanner, an update manager to check for and install the latest virus definitions from the Avira servers and there's a TeamViewer assistant where you can open up a channel with the Avira support team, who can then take control of the system – providing you're connected to the internet, of course – and run through the checks for you.



▲ The Avira Rescue System interface is Ubuntu-based and looks good

On its own, the Avira Rescue System is simply an Ubuntu live desktop, so you can easily access the Windows partitions and manipulate any files, copy folders to the network and do all the usual rescue tasks prior to wiping your system and starting again. The virus scanner is an excellent added benefit, as is the TeamViewer connected support. However, these two options are where Avira fell.

The virus scanner worked through our test virtual machine, a machine where there are three viruses present. After two hours of scanning it reported back that it didn't find any viruses and that the system was clean. So far not so good. Sadly, for whatever reason, the virus scan utterly destroyed the Windows 7 virtual machine. We couldn't boot back into it and what's more we couldn't even access the partition after rebooting with the Avira Rescue System.

To double-check it wasn't us doing something wrong, we went through the process again, this time it only took five minutes, reported the same clean system and again

did something to the file table to make inaccessible and totally useless.

We did try to use the TeamViewer assistance to help us out, but again Avira Rescue System failed and we couldn't even establish contact the Avira support site, even though we could happily visit everywhere else on the internet.

In theory, the Avira Rescue System is a great concept and it should work brilliantly. In practice, however, it didn't perform particularly well. Based on our brief experience we'd recommend you avoid the Avira Rescue System and instead look to any of the other rescue discs on test within this group.



AVG Rescue CD Business Edition

DETAILS

- Price: Free
- Manufacturer: AVG
- Website: goo.gl/xe8jRD
- Requirements: 1GB RAM, 600MHz CPU, 1GB USB stick

AVG is one of the old guard of AV products aimed at the home and business user.

While it enjoyed some popularity a few years ago, with its free AV product, the company has since seen a reduction in its user base – since Windows 8.1 and 10 bundled the MS AV, undoubtedly.

However, that doesn't mean the company has dropped the ball in terms of the products it offers. In this instance, the AVG Rescue CD Business Edition is regarded as one of the better rescue discs available. Although Business Edition is in the title, it doesn't mean that it's exclusively for enterprise environments, as the personal user can get a lot from it too.

This is an extremely small Linux-based rescue image, weighing in at just 160MB it's a text-based system that enables you to scan the host system for viruses, run various scripts to help fix common issues, mount encrypted file systems, fix the Master Boot Record, recover deleted files, run a drive S.M.A.R.T. test, test the installed hard drives, edit the Windows registry, run a file manager (Midnight Commander, in this case), ping a remote system and even run a text-based browser.

To begin with the AVG Rescue CD will run a quick identifying scan of the host file



▲ The AVG interface may look simple, but there's hidden powers here



▲ There are loads of tools and plenty to help rescue your PC

“ There's something pleasingly simple about the AVG interface ”

system, then it'll scan for a network connection and offer the option to update the AV signatures. Beyond that, you're left with a text menu system with the various options.

While it lacks a GUI, there's something pleasingly simple about the AVG interface.

Perhaps it's the old school look and feel that makes it such a reassuring and user-friendly environment? Whatever the reason is, it is undeniably quick in its operation.

Without the weight of a GUI behind it, the AVG tasks are very quick at completing. The

scan takes just ten minutes on our test system and it's accurate too, identifying the few viruses we intentionally installed and quickly removing them. Likewise, the other functions performed magnificently, and we even liked the text-based browser, although it did feel more of a novelty as opposed to something really useful.

The only negative aspect could really be the lack of mouse integration and GUI, despite us loving the simplified interface. A text-based UI isn't to everyone's tastes and the beginner may feel a little out of their depth by the lack of explanations for each of the tools available.

It's a small niggle, but one that we feel needs to be addressed to cover a broader range of users, as opposed to those of us who dealt with such DOS-like interfaces from years ago.

Overall, the AVG Rescue CD Business Edition is an excellent tool to have in your arsenal. It's small, quick, easy and contains more than enough tools to help you rescue your poorly system.



Rescue Discs

Dr.Web LiveDisk

DETAILS

- Price: Free
- Manufacturer: Dr.Web
- Website: goo.gl/LJntBr
- Requirements: 1GB RAM, 700MHz CPU, internet connection

Dr.Web's LiveDisk is the newly named version of the original Dr.Web Live Rescue CD that proved to be popular around five or six years ago. Since then not much has been seen of Dr.Web in the media, but the company is still going strong and its latest version of the rescue disc has seen some updates.

We've always found Dr.Web to be an amusing title, reminding us of a James Bond nemesis as opposed to something you'd use when your PC decides to stop booting. Instead this Linux, MATE desktop rescue disc offers a decent selection of tools to help you breathe some life back into the dead PC.

It boots to MATE, together with auto-launching the Dr. Web CureIt! program, which will scan your system for any viruses and infecting malware. The scan on our test system took around twenty minutes, which isn't too bad and it did find the intentionally left viruses and cleaned them from the system.

Interestingly Dr.Web LiveDisk uses the Bitdefender virus database to scan for viruses, worms, rootkits, Trojans, spyware and so on, so the scanning side of things is in safe hands.

Beyond the virus checker, Dr.Web offers a Windows registry editor, Firefox



▲ *Dr.Web sounds like a Bond baddie, but it's really very good*



▲ *There are plenty of tools on offer and it's quick too*

“ Interestingly Dr.Web LiveDisk uses the Bitdefender virus database ”

browser, a file manager, Terminal, the Midnight Commander and the ability to check for and install any updates for the virus database. The company has also pre-installed a copy of

Wine, so you can run any external Windows programs from within the Dr.Web Livedisk environment.

Despite this being a relatively unknown rescue disc, compared to something

like AVG, for example, it's really quite good. A lot of thought has gone into the presentation, thankfully all the links and pre-installed programs work well, and it works exceedingly well. It's not as quick as the AVG disc we've already looked at, due to it using a fully-blown GUI as opposed to a text-based interface, but it holds its own without too much difficulty, and it's infinitely better than the offering from Avira.

In short, then, Dr.Web LiveDisk is a good place to start if you're after a rescue disc that can handle accessing a Windows partition, while offering scanning capabilities and access to the internet. It's quick, effective and looks good too. The advantage over the AVG disc is naturally the GUI, which may appeal to some users, otherwise it's a perfectly good addition to any users' digital toolbox.

The only major downside is possibly the 600MB ISO size, but given most people have ample USB storage devices these days it shouldn't present too much of a problem.



SystemRescueCD

DETAILS

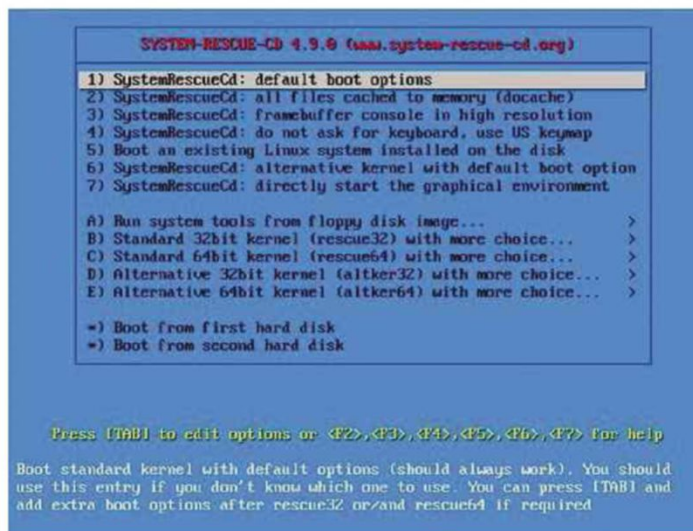
- Price: Free
- Manufacturer: SystemRescueCD Community
- Website: goo.gl/Fx4uhG
- Requirements: 1GB RAM, 700MHz CPU, internet connection

The multi-lingual SystemRescueCD has been available for download for well over a decade, and although it hasn't changed too much in its appearance in that time, it has moved with the times and used the latest versions of the Linux kernel.

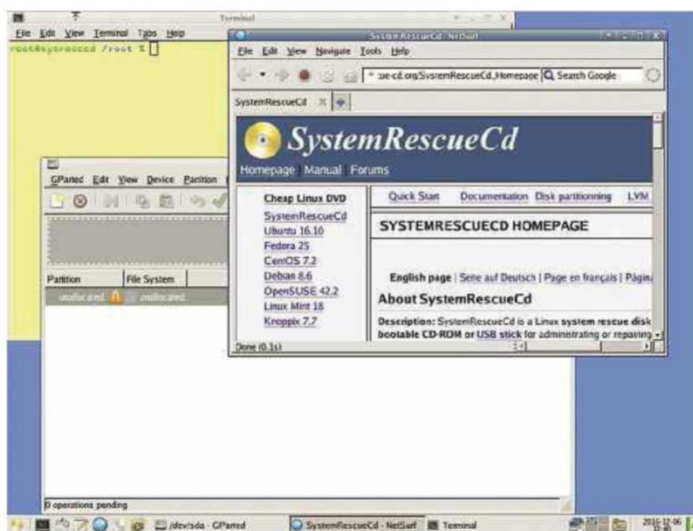
This is more of an advanced user's rescue disc, in that it doesn't offer a nice text interface or graphical desktop when first booting up. Instead you get a Linux command line console and from there you can opt to configure your network, mount any of the host's drives and partitions, access a web browser in the console or if you really require a GUI enter StartX to power up the XFCE desktop.

Booting to the desktop isn't for the beginner user, though. While it's still a GUI, it's not quite as user-friendly as the disc from Dr.Web. However, you do get the usual accessories and system tools that most basic Linux distros offer, such as Bulk Rename, file managers, GParted, the Midnight Commander and a Terminal.

Naturally you can access a Windows partition easily, to alter, copy and manipulate the files and folders within, but there's no virus scanner or ability to easily edit the Windows registry. These



▲ The minimalist approach of SystemRescueCD isn't for the beginner



▲ But it can be expanded on and it's a good tool to own

“ It's multi-lingual, has a huge documentation resource and an active forum ”

options can be download and installed, of course, but out of the box SystemRescueCD is simply a lightweight Linux distro that gives you access to a host computer's file system.

The 492MB ISO is reasonably small, and thanks to the lightweight nature of XFCE, SystemRescueCD certainly operates quickly. It's not as simple to use as the previous examples we've

looked at, but it's probably as quick at navigating and interrogating the host computer's file system as AVG's text-based rescue media is.

The major issue with SystemRescueCD is the lack of useful, out of the box tools, such as the ones from the AVG and Dr.Web examples. As we mentioned, it's easy enough to include these, but doing so takes time and requires a higher degree of knowledge than simply booting into the rescue environment and running a program.

On the plus side, it's multi-lingual, has a huge documentation resource and an active forum. Should you need to delve deeper into the inner workings, add more programs and do more with SystemRescueCD, then there's likely someone available to help you out within the community.

If you're not wanting to get more out of SystemRescueCD and you want something that feels a little more complete out of the box, then we'd say stick to either AVG or Dr.Web.



Rescue Discs

Paragon Rescue Kit 14 Free Edition

DETAILS

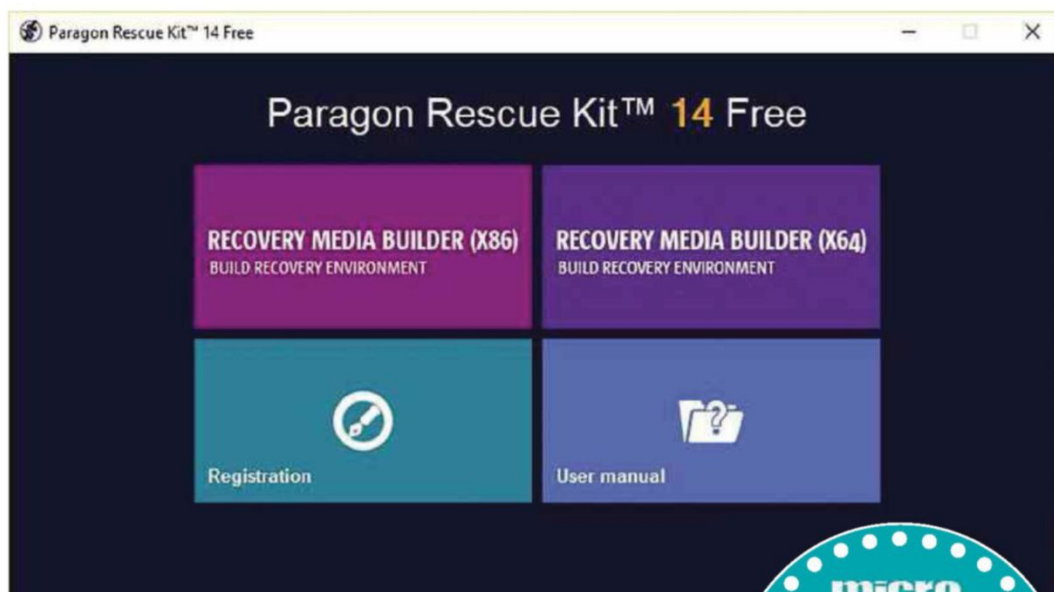
- Price: Free
- Manufacturer: Paragon
- Website: goo.gl/TUAbgm
- Requirements: 1GB RAM, 700MHz CPU

We reviewed Paragon Rescue Kit 11 back in 2011 and while good it really only ever touched the tip of the rescue disc iceberg, leaving out many of the additional and useful tools that the other rescue discs featured out of the box. Has it improved since then?

The Paragon Rescue Kit is a little different from what we've already looked at. This is a Windows PE-based rescue desktop, one that downloads to a reasonably sized 300MB executable. From there you can opt to create a Windows PE ISO where you'll boot into in the event of an unbootable PC. To note, though, you will need a free licence number from Paragon, but the link is available from the setup process.

Once the bootable environment is created and you're in you can easily navigate the available options. There's a backup to a virtual disk option, restore from virtual disk, access to the user manual, a more traditional backup and restore function – that backs up to a network resource or second drive (internal or external), an option to transfer any files and to load any specific drivers, such as a RAID setup.

Within each of the available options are further settings that will fix your boot sector, a password cleaner to wipe all current Windows passwords



▲ The Paragon Rescue Kit 14 Free Edition uses a Windows PE install to work on



▲ While good, it's not as effective as some of the other examples in the group



True, it'll do a good job of getting your PC back on its feet again. But it's missing a virus scanner and a more advanced way of getting to the files and folders, especially the permissions of each. These are all elements that come with AVG, Dr.Web and SystemRescueCD – minus the AV side of things with SystemRescueCD.

The feeling then that Paragon Rescue Kit 14 is still only the tip of the rescue toolbox iceberg is once again present. There's plenty more the company could do to improve the available tools and to add others.

While good, then, and certainly worthy of checking out, we feel it's just not quite up to the same standard as some of the other discs in this group test.

“ It's missing a virus scanner and a more advanced way of getting to the files ”

and a Windows registry editor, among others.

The environment is reasonably quick, and it's certainly friendly enough for the vast majority of users, since it's Windows PE as

opposed to a Linux desktop. However, despite the new environment look, compared to version 11, which we reviewed all those years ago, it feels like a lot was left out of Paragon Rescue Kit 14.

Bitdefender Rescue CD

DETAILS

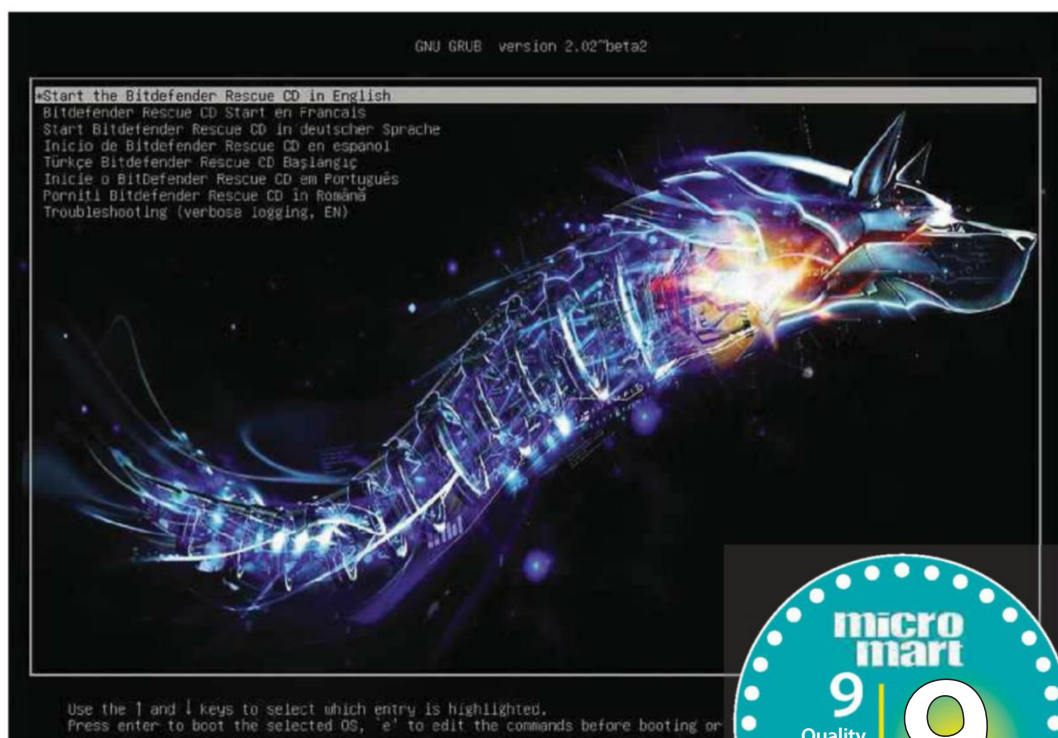
- Price: Free
- Manufacturer: Bitdefender
- Website: goo.gl/1fwUJ8
- Requirements: 1GB RAM, 700MHz CPU, internet connection

Bitdefender has certainly improved as an AV provider and security company over the last five years or so. It's now regarded as one of the best PC and system security companies in the industry, and that's hardly surprising when you consider the excellent virus database and scanning engine it's developed.

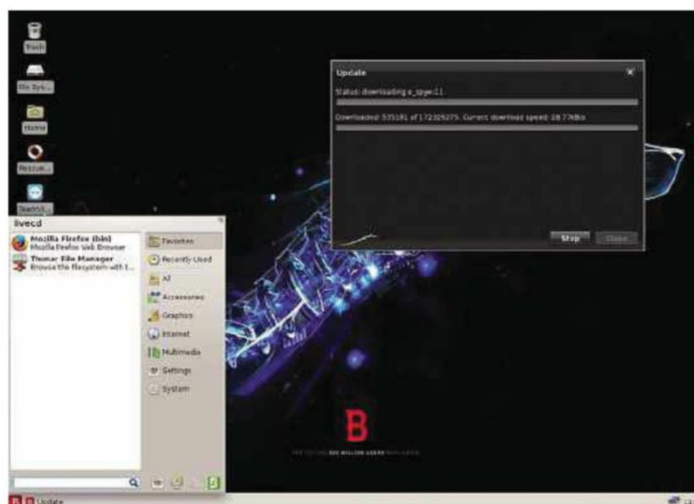
Beyond the total system security programs, Bitdefender also produces a number of free tools and utilities, of which the Rescue CD is one.

This is a Linux-based system that downloads to a 660MB ISO ready to be transferred to an optical disc or USB device. Its main feature, naturally, is the anti-virus engine and scanner, which is quite superb. On starting, via an icon on the XFCE desktop, it checks and downloads any updates, then begins to scan the host system. Once complete, an operation which took just ten minutes and found the intentional viruses we have on the virtual machine, it'll display the results and the actions taken to clean the PC.

It's worth mentioning too that the AV engine and access to the Bitdefender database is actually the same as you'd get on its premium grade Total Security suites. Obviously there's a lot of the AV interface missing in this example, since you're not paying for it, but on the whole having the same excellent AV scanning technology is worth



▲ *The Bitdefender Rescue CD is a great AV and rescue companion*



▲ *There are loads of tools available and it's pretty quick too*

downloading this rescue disc alone.

Beyond the virus scanning, you have access to the file system through Thunar File Manager, GParted, Bulk Rename, a disk analyser, web browser, image viewer, sensor viewer, Terminal and you can set up a TeamViewer

instance where Bitdefender's experts can connect to your system to help you solve any issues. There's also a helpful set of documents walking you through the rescue CD process, should you require it.

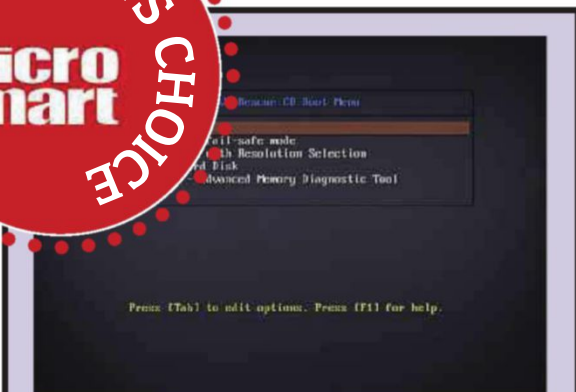
It would be good to have a few extra options available, such as a Windows registry

editor or some form of backup and restore agent out of the box. However, as with most Linux-based rescue tools we've looked at so far, these can be easily included should you have access to the internet.

The Bitdefender Rescue CD is reasonably quick to access and navigate, even the host file system. It's not as quick as the AVG or Dr.Web examples, but there's probably only fractions of a second involved, so it's not like you're going to be waiting for it to access the system partition for too long.

Overall the Bitdefender Rescue CD is a great resource and most definitely one that will be placed into our digital toolkit. There is room for a few extras out of the box, but these can be added via the usual Linux installation method.





AVG Rescue CD Business Edition

Although it lacks a GUI, there's something really refreshing and overall good about the AVG Rescue System.

It's quick, there are plenty of tools and utilities available, and it's an extremely effective tool at helping out when things go wrong and breathing new life into a dead PC.



Bitdefender Rescue CD

While the Bitdefender Rescue CD may lack one or two resources the others have, it's easily one of the best rescue companions available.

The AV side of things is excellent and you can achieve most other tasks without too much trouble. If in doubt about it, the Dr.Web LiveDisk disc will fill in where Bitdefender left off.

How We Tested

Each Rescue ISO image was burnt to CD and tested on a virtual machine. The default OS was Windows 7, with three viruses/malware installed – W32.Conficker.Worm, W32.Rontokbro.Z@mm and Worm.Win32.AutoIt. Although old, they still appear to this day.

	Avira Rescue System	AVG Rescue CD Business Edition	Dr.Web LiveDisk	SystemRescueCD	Paragon Rescue Kit 14 Free Edition	Bitdefender Rescue CD
ISO Size	671MB	160MB	600MB	492MB	300MB	660MB
Online Update	Yes	No	Yes	No	No	Yes
Anti-Virus	Yes	Yes	Yes	No	No	Yes
File Manager	Yes	Yes	Yes	Yes	Yes	Yes
Network Tools	Yes	Yes	Yes	Yes	Yes	Yes
Web Browser	Yes	Yes	Yes	Yes	No	Yes
Terminal/Command Line	Yes	Yes	Yes	Yes	No	Yes
Partition Editor	Yes	Yes	Yes	Yes	No	Yes

Linux: From A-to-Z

David Briddock continues the series with the letter O

This week's topics are open source, old PCs, the Okular app and the Ogg multimedia file format. So let's get down to it, time's a wastin'!

Open Source

It's thanks to open source licences that we have access to so many free Linux-based distributions. These license agreements ensure all the core Linux code is freely available for download and can be read, changed, recompiled and redistributed. The main licence associated with Linux is the GNU General Public License (gnu.org/licenses/gpl-3.0.en.html). Known as a 'copyleft' licence it gives anyone the freedom to run the software, to study the code and to make changes. It also gives the freedom to redistribute copies of the software, with or without additional modifications.

SourceForge was one of early online source code repositories to gain worldwide popularity. More recently, the Git language powered GitHub website (github.com) has grown into an essential resource for the open source community.

Old PCs

It happens to every PC owner at some point. Eventually, that old desktop or laptop can't support the latest Windows operating system or simply just runs too slowly to be usable. There's no need to throw it away, though. Linux can breath new life into that ageing hardware for free.

The best Linux distribution depends on the age and memory capacity of your PC. But a good plan is to install a lightweight Linux distro image first. These have a slimmed down graphical desktop that runs smoothly in a little as 256 MB of RAM, yet still runs modern web browsers, office tools and multimedia apps.

Two of the most popular lightweight examples are Puppy Linux and the Ubuntu-based Lubuntu. Other examples include the Lubuntu-based Peppermint OS, or Puppy Linux-based Macpup, which attempts to deliver an Apple Mac-like desktop experience.

Okular

Document management tools are a vital aspect of any desktop environment, and one of the best known Linux options is Okular. Originating from the 2005 Google Summer of Code, the Okular app is now supported by the KDE community. Today, it's also available for Windows and macOS platforms. It supports a variety of document formats; some of the most common being PDF, Postscript, ePub, XPS, Open Document Format (ODF) and XML, but it also supports images including JPEG and the Tagged Image File Format (TIFF).

When working with PDFs the annotation features include comments, highlighting, line drawing, geometric shapes, text boxes and stamps. Annotations can be stored separately from an unmodified PDF file or in the document itself as standard PDF annotations.

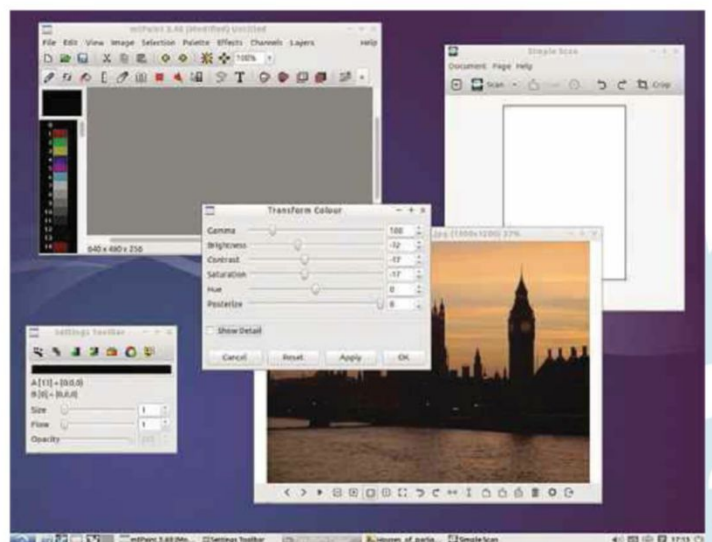
Ogg

While there are many compressed audio/video formats around, MP3 being chief among them, most rely on a certain amount proprietary codec software to work. While this won't worry most people, some open source devotees insist on a using a 100% free and open source solution for their carefully chosen open source Linux distro.

Thankfully, there's a solution at hand in the form of the fully open source Ogg standard. Maintained by the Xiph Foundation (xiph.org) Ogg delivers a high-quality digital multimedia experience unrestricted by software patents. Both lossless and lossy compression downloads formats are available.

Ogg files can identified by their extension, for example '.ogg' or '.oga' for audio files and '.ogv' for video. The standard has many impressive features, such as the ability to multiplex a number of independent audio and video streams along with text and subtitles into a single '.ogx' file. [mm](#)

“ Ogg delivers a high-quality digital multimedia experience unrestricted by software patents ”



▲ Lubuntu Desktop

Tiger feat: the number of tigers living in the wild is slowly increasing

Wild Thing

Madeline Bennett explores how technology is being put to use to protect our planet and save endangered species

What do the black rhino, South China tiger and Sumatran elephant all have in common? They all have the misfortune to be listed as critically endangered on the World Wildlife Fund (WWF) Species Directory, meaning they face a very high risk of extinction in the wild. As well as the 18 creatures categorised at this highest risk level, a further 29 are endangered, meaning various whale, turtle and gorilla species are all facing serious risk of extinction. Another 19 species, from the polar bear to the dugong, are earmarked as vulnerable to become endangered unless their circumstances improve.

But luckily for these creatures, technology could save the day. Thanks to the efforts of conservation groups, academics and technical experts around the world, work is under way to sort out the mess that us humans have made of the natural world and right some of the wrongs before it's too late, and dugongs go the way of the dodo.

Here we take a look at seven ingenious projects and how they're taking advantage of the latest technical advances to protect everything from the birds to the bees.

Poaching The Poachers

Much of the tagging, tracking and monitoring efforts of conservationists focuses on the animals themselves. However, technology can be used to protect wildlife without actually having to impact the wildlife itself, according to tech company Dimension Data and networking giant Cisco.

The two firms have teamed up to develop and deploy monitoring technology and alert systems that track people rather than animals, in a bid to reduce rhino deaths from poachers hacking off their horns, and remove the stress that can be put on animals during the tagging process. So far, the technology has been deployed at a private game reserve next to Kruger National Park, South Africa.

The first phase of the project began in December 2015. Dimension Data worked with Cisco to gather information from game rangers, security personnel, and technology and control centre teams, which was then used to create a secure Reserve Area Network (RAN) and install Wi-Fi hotspots around key points. The RAN covers the entire reserve – 50,000 hectares – and lets rangers share alerts, warnings and live

video footage over a secure and reliable communications network.

The project is also using advanced technology such as drones with infrared cameras, thermal imaging, vehicle-tracking sensors and seismic sensors, all able to provide information on movement in and around the park, and feeding data back to the secure intelligence network.

The aim of the project is to stop people entering the reserve illegally, whether by cutting a fence, being dropped on to the ground by helicopter or driving in through the entrance gates. Every individual who enters the reserve has their fingerprints taken and stored along with their ID number. Passports are scanned and car registrations captured via cameras. If a fence is cut anywhere in the reserve, a sensor will trigger an alert and the security team can react rapidly; if someone with a criminal record tries to enter the reserve, that information is immediately available to assess.

According to the latest figures from South Africa, 1,215 rhinos were killed by poachers in 2014 – an average of more than three rhinos a day – in a bid to collect the horns, which



▲ *Technology is being used to protect rhinos living near to South Africa's Kruger National Park*



▲ *Trunk call: elephants are threatened by poachers who kill the animals for their tusks*

are still a sought-after element of traditional Asian medicines and can be sold on the black market for huge profits. At this rate, the rhino would be extinct in South Africa by 2025. Alerting systems such as this can hopefully roll back the clock and put an end to, or at least massively reduce, poaching.

Cisco and Dimension Data also plan to replicate the technology in other areas across the globe, aiming to protect other endangered species like lions, pangolins and even sea rays in the ocean.

“ Data mining makes it easier to locate and identify illegal ivory items being sold on the web ”

Feathered Friends

The Royal Society for the Protection of Birds (RSPB) might be rather ancient at 127 years old, but it is certainly keeping up with its younger counterparts when it comes to technology use. The avian protector teamed up with data specialist SAS more than a decade ago in a bid to tackle some of its biggest problems, ranging from commercial fishing lines accidentally trapping albatrosses, to increasing ocean temperatures killing off the food supply for sea birds.

The RSPB and SAS collect vast amounts of data via tags, tracking and monitoring habitats and wildlife, and analyse this information to work out the best ways to protect various birds and test out different conservation projects. Will Peach, head of research delivery for RSPB, explains: “We need to make sense of a variety of large and complex data sets. For example, tracking the movements of kittiwakes and

gannets as they forage at sea produces millions of data points.

“Conservation informed by evidence is always more likely to succeed than that based on guesswork or anecdote. SAS enables us to produce the firm scientific evidence needed to confidently implement our initiatives.”

The partnership is still going strong, based on successes so far. The data uncovered by SAS technology has helped conservationists understand the impact of farm lands and pesticides on avian welfare,

revealing that changes in cropping affect skylark nesting, for example, while pesticide use affects the chances of yellowhammers successfully breeding.

The project has also reduced albatross fatalities. The RSPB and SAS carried out research on the albatross population, and discovered that tens of thousands of the birds were being killed every year as a consequence of large-scale, commercial longline fishing. Study of albatross foraging habits led to the development of fast-sinking fishing hooks, which are less likely to snag the majestic birds.

Ivory Tracking

One of the biggest threats to elephants is the continued demand for ivory, and the illegal underground market that makes it possible to keep selling tusks, even though they're banned items. This ivory is hacked off the heads of elephants with machetes or chainsaws while they're lying wounded and

sometimes already dead, having been expertly tracked by groups of armed poachers.

Much of the effort to protect these critically endangered species focuses on stopping the poachers before they can do their damage. The University of Kent is taking a different approach, and is trying to make it impossible to sell ivory trinkets and items, and therefore prevent anyone profiting from elephant deaths.

The university has developed an automated data-mining computer system designed to curb ivory trading via better classification. The idea is to make it easier to locate and identify illegal ivory items being sold on the web among the thousands of search results for legitimate ivory items, such as a wedding dress or bed sheets. Tracking banned products is also made harder by the fact the traders steer clear of the term ivory to avoid getting caught.

Developed by Dr Julio Hernandez-Castro, a computing lecturer at the university's School of Computing, in conjunction with the university's School of Conservation and Anthropology, the automated system is able



▲ *Data collected by the RSPB is helping to protect the yellowhammer*



© Joseph Vartakaven/WWF- Russia



▲ Dugong numbers have declined by 30% in the past 60 years

to mimic human expert classification of illegal elephant ivory, at a fraction of the cost, and thousands of times faster.

A team of experts were pitted against the university's machine-learning algorithm to assess items on sale in the antiques section of eBay, and consider whether any ivory was potentially legal or illegal. The experts were also able to make use of item descriptions and images unavailable to their computer rival. However, the automated system still achieved a 93% accuracy rate, a result that could have a huge impact on cutting down the opportunity and profits for the ivory trade.

Virtual Tigers

The WWF is one of the biggest animal charities across the globe, with a broad scope both in projects and countries of operation. The organisation has long been an avid technology user to promote its work, from tracking polar bears via radio collars to using social media to drum up support for Earth Hour. One of its latest projects has seen the organisation leap into the world of virtual reality (VR), to offer a close-up encounter with a wild tiger.

The WWF launched its VR experience earlier this summer, offering viewers the chance to step into the boots of a game ranger, check a camera trap and even catch a glimpse of a wild tiger.

Anyone with a VR headset or Google Cardboard can immerse themselves in the jungle and come face to face with tigers. But even if you don't have a VR device, you can still watch the video on YouTube and get a 360° view.

There have already been some small successes in increasing tiger numbers. By 2010, tiger numbers had dropped to 3,200, down from 100,000 a century ago; between 2000 and 2014, parts from at least 1,600 tigers were seized, feeding the multibillion-dollar illegal wildlife trade.

However, the numbers are creeping back up. By April 2016 it was estimated that there were close to 4,000 tigers living natural lives in their jungle habitats.

However, tigers still need a big helping hand to get off the critically endangered list, and the VR experience is aimed at encouraging WWF tiger adoptions to raise funds for more conservation work.

You can view the virtual-reality tiger at tinyurl.com/346wildthing – if you're brave enough.

Under The Sea

Wildlife campaigns often focus on the more photogenic or majestic beasts to capture public attention, and raise support and funds. However, there are many creatures out there that may not have the appeal of a tiger, rhino or elephant, but are still worthy of conservation efforts. One such creature is the dugong, a vegetarian sea mammal dwelling in warm coastal regions such as East Africa and Australia.

These sea cows, as they are otherwise known, are officially categorised as vulnerable,

and figures suggest the population has declined by 30% in the last six decades, due to entanglement in nets, illegal hunting and habitat loss.

Thanks to a collaboration between three organisations, dugongs are now at the centre of a conservation effort. IoT cloud platform provider Kii, NGO Community Centred Conservation (C3) and Smart Earth Network (SEN) have started a project from the island of Busuanga in the Philippines to record dugong sightings and help preserve the species.

Kii has provided a cloud platform letting local fishermen take a picture on their smartphone when they see a dugong and upload the image to the online repository. Each image indicates the exact location of the sea mammal via GPS.

Around 30 fishermen have been provided with smartphones from a local mobile provider, Cherry Mobile, for the trial phase. The collected images will build up a precise, comprehensive overview of the dugong population and help target conservation activities.



“Traditionally, we have had to track these amazing sea creatures from the air, which is expensive and unreliable,” explains C3’s Chris Poonian.

“Using mobile phones to monitor them is an innovative approach. This collaborative project is one of the first of its kind to employ this kind of technology. If successful, IoT and mobile technology could have important applications for surveys of rare species throughout the world.”

According to Poonian, the project is progressing well, although it took longer than expected to deal with issues such as ensuring that phones stay charged and get a good enough 3G signal to upload data.

“The mobile network in the Philippines is expanding at a phenomenal rate, so we expect that the signal issues will sort themselves with time,” he adds.

“To date, the data we have collected has confirmed the results of our previous work, indicating the most important dugong areas. We hope to have funding for a dedicated staff member early next year,



▲ The University of Kent is using computers to combat the illegal ivory trade



▲ Marla Spivak’s compostable beehive may help to save the honey bee

which will mean that we can sort out the final niggles and start collecting some solid empirical data. The funding will support the demarcation of marine protected areas, focusing on dugongs, so the phone data will contribute directly to those aims.”

Finding Nemo

Fishermen are also being called on across the pond to do their bit for conservation while partaking in their favourite hobby. It may seem strange that a pastime involving the death of creatures is helping to save other creatures, but that is the case thanks to a partnership between mobile angling app Fishbrain and the US Fish and Wildlife Service (USFWS). Fishbrain’s two million US users have been asked to keep an eye out for 50 endangered species, including birds, mammals and amphibians, while out fishing.

The Fishbrain app helps users to identify the species and document sightings. This data is then available to conservationists and academics to determine location, habitat required and causes of decline.



▲ Fishermen in the Philippines are snapping sea cows on their phones

So far, anglers have successfully located and caught many of the 50 listed species, including the pallid sturgeon and little kern golden trout (above right).

“Anglers are extremely important to protecting and maintaining healthy aquatic habitats,” enthuses Gary Frazer, assistant director of the USFWS’s Ecological Services Program.

“This is a unique opportunity to synthesise recreational anglers’ information and knowledge in local waterways and expand our understanding of various species.”

A Mite-y Effort

From the sea to the air: honey bees are also becoming endangered – which is bad news for us humans, as they are vital to our food chain. Colony collapse is a phenomenon where an entire hive will die off incredibly quickly, and scientists have identified the Varroa mite as one of the biggest suspected causes. These mites use the hives to breed, and transfer viruses to the bees, wiping them out.

Professor Marla Spivak at the University of Minnesota has made use of machine-to-machine technology from technology firm Gemalto and software from agricultural communications company Eltopia to develop a way to sterilise the mites without resorting to pesticides, preventing them from breeding and taking over hives.

The MiteNot project uses a compostable smart beehive frame that can automatically monitor and manage the temperature of beehives. By applying heat at a specific temperature and time during the mite breeding cycle, the solution is able to interrupt fertilisation and prevent further mite reproduction. [mm](#)

Micro Mart's Festive Fun & Games

Puzzle till your puzzler is sore!

Christmas time is upon us, and we're breaking with Micro Mart tradition this year. Yes, we're actually going to acknowledge it's happening!

As we all know, however, the festive season can be far from cheerful. The weather's rubbish, you have to spend all your money on other people, and the shops are absolutely

packed with folk who have left their gift shopping until the last minute. It's a massive pain sometimes, but hopefully we can brighten your day with a little gift of our own: a fine selection of hand-crafted puzzles, quizzes and random seasonal frivolity.

So get your pens at the ready, dear readers. It's puzzle time! (Answers on page 67.)

Let's Get Quizzical!

1. Sandy Bridge, Ivy Bridge... What came next?

- a. Millennium Bridge
- b. Skylake
- c. Sky Fall
- d. Haswell

2. Who co-founded Microsoft with Bill Gates?

- a. Steve Ballmer
- b. Paul Allen
- c. Paul Chuckle
- d. Satya Nadella

3. What did Samsung sell when it first began business in 1938?

- a. Microwave ovens
- b. Luxury gloves and hats
- c. Gardening shears
- d. Dried fish and other foods



◀ Paul Chuckle. Quite possibly had nothing to do with founding a multi-billion dollar software company

4. Today, Nintendo's moustachioed plumber Mario is known the world over. But what was he originally called?

- a. Matteo
- b. Super Plumber
- c. Jumpman
- d. Dave

5. Which of these is not a real Sega console?

- a. Genesis
- b. Pico
- c. Mega System
- d. Saturn

6. What does DAB stand for?

- a. Digital Audio Broadcasting
- b. Digital Audio Bandwidth
- c. Danish Apple Board
- d. Differered Aural Broadcasting

7. What did Dr Jaap Haartsen invent?

- a. DVD
- b. Noise-cancelling microphones
- c. Bluetooth
- d. Fridge magnets



8. What did Psion engineers say the name of the EPOC operating system meant?

- a. Elevated Processing On Chip
- b. Electronic Piece Of Cheese
- c. Every Person Orders Curry
- d. Electronic Portable Organiser Complete

9. In what year did Micro Mart launch?

- a. 1985
- b. 1990
- c. 1988
- d. 1971

10. Which one is the best?

- a. Commodore 64
- b. ZX Spectrum
- c. BBC Micro
- d. Er... we're not getting involved!

Guess The Christmas Techie!



▲ Christmas is expensive. Maybe he can pay the bill?



▲ This chap loves Christmas almost as much as he loves his company

We've cunningly disguised five famous technology peeps with some high-quality Santa gear from the Micro Mart dress-up cupboard. Can you guess who they are?



Want to stay off Santa's naughty list? Then don't be evil!



▲ Our friend here loves nothing more than chilling out in the North Pole with his penguins



▲ The true 'face' of Christmas?

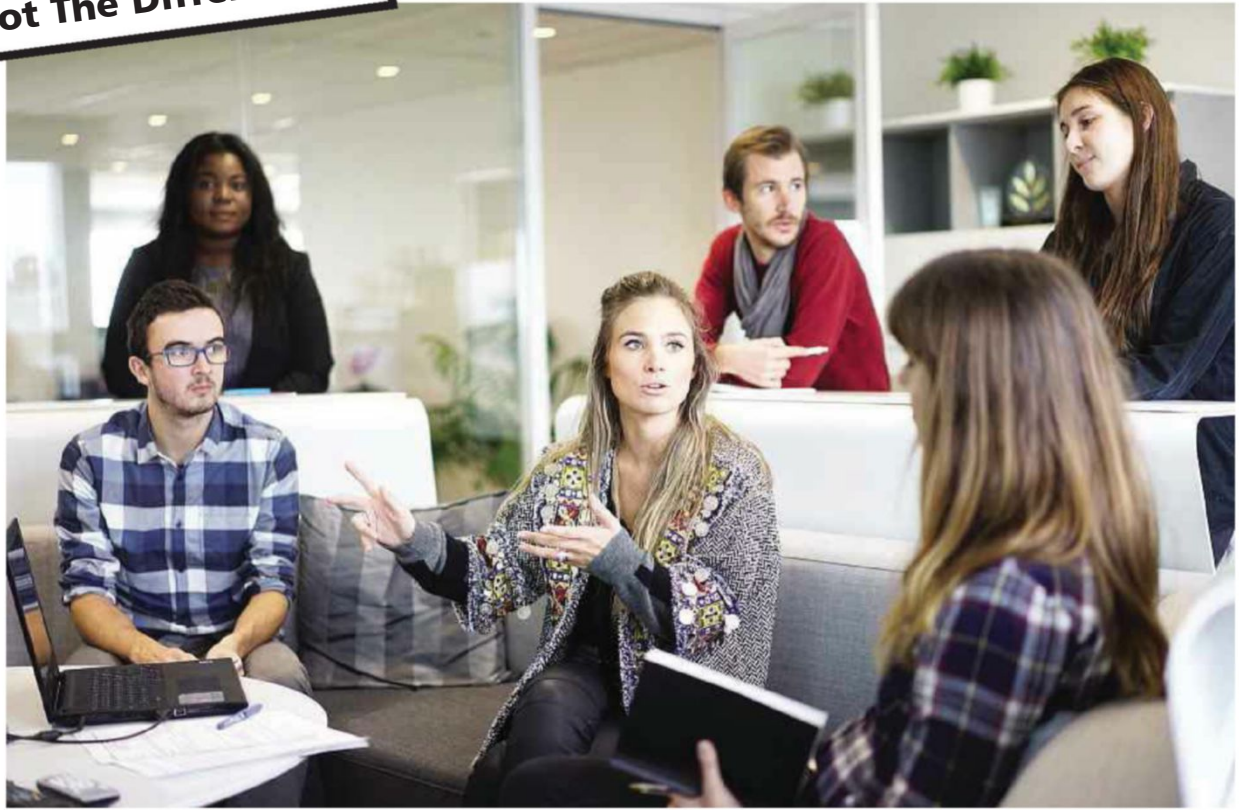
A Word Search!

Can you find our 10 techie words?

- Broadband
- Computer
- Graphics
- Internet
- Keyboard
- Monitor
- Motherboard
- Mouse
- Printer
- Website

J R Y W V M G H V E K R G E B S B G L M K P V J Y Y D O E X
 J O R R W F C T A E E Z O H R R K J Z X C G P C K Y E T J W
 V T R E Z P N M Y T Q T V O P C O F X C J Q L O J Y W Z F I
 B I N P M Z Z B N T M U E E M S C A S U Z X R M S B K B H P
 K N R Z Y I O I L I L O P N N M C U D K V G S P D P L Y B Z
 Y O L X W A R D P O T F H V R F O J P B R J X U E Q V W O H
 T M Q X R P J C D C U F B S Z E T U H Q A Q S T T R Q R I P
 Z N I D H K F S D X T E W R R W T L S F Q N W E G R A Q M Q
 G S A W B V G P W E B S I T E Z E N H E S G D R T L O X L Z
 V A Q X P M O T H E R B O A R D S C I H P A R G J X J T G D

Spot The Difference!



Up and down the country, colleagues are making plans for their work Christmas parties. Obviously, the people in this photo are too young and attractive to be working for us, and we have no idea what they're actually talking about. It's a stock image, though, so we're guessing nothing. Anyway, can you find the seven subtle changes we've made to the copy on the right?

Anagram Fun!

We've taken 10 words, related to either technology or Christmas, and jumbled them up. Can you work out what they're meant to say?

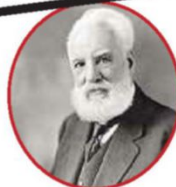
1. LPTPAEFO
2. EGGBAYIT
3. UTKYER
4. IMCEN PSEI
5. AMLEAHNICC YKBDAORE
6. AN TSA LACUES
7. PRUSE RPCUOMET
8. ACRHISSMT ETRE
9. GHHI ONFDEINTII
10. TRIVULA TRYEALI

The turkey's finished, and everyone's pulled the crackers. Now it's time for dessert, but your guests' orders have been mixed up. Find out what each of them is having – before they leave early and get an ice cream on the way home!

Famous British Inventors Christmas Dinner Mix-up



John Logie Baird



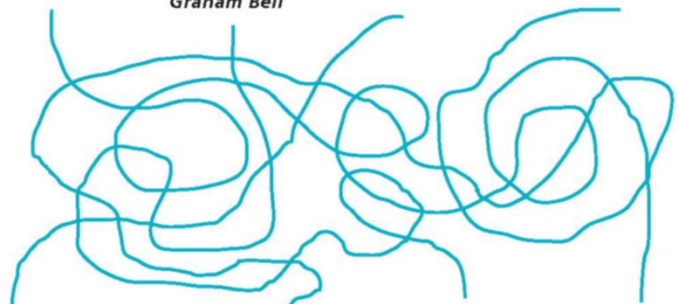
Alexander
Graham Bell



Charles Babbage



Tim Berners-Lee



Chocolate cake



Cherry pie

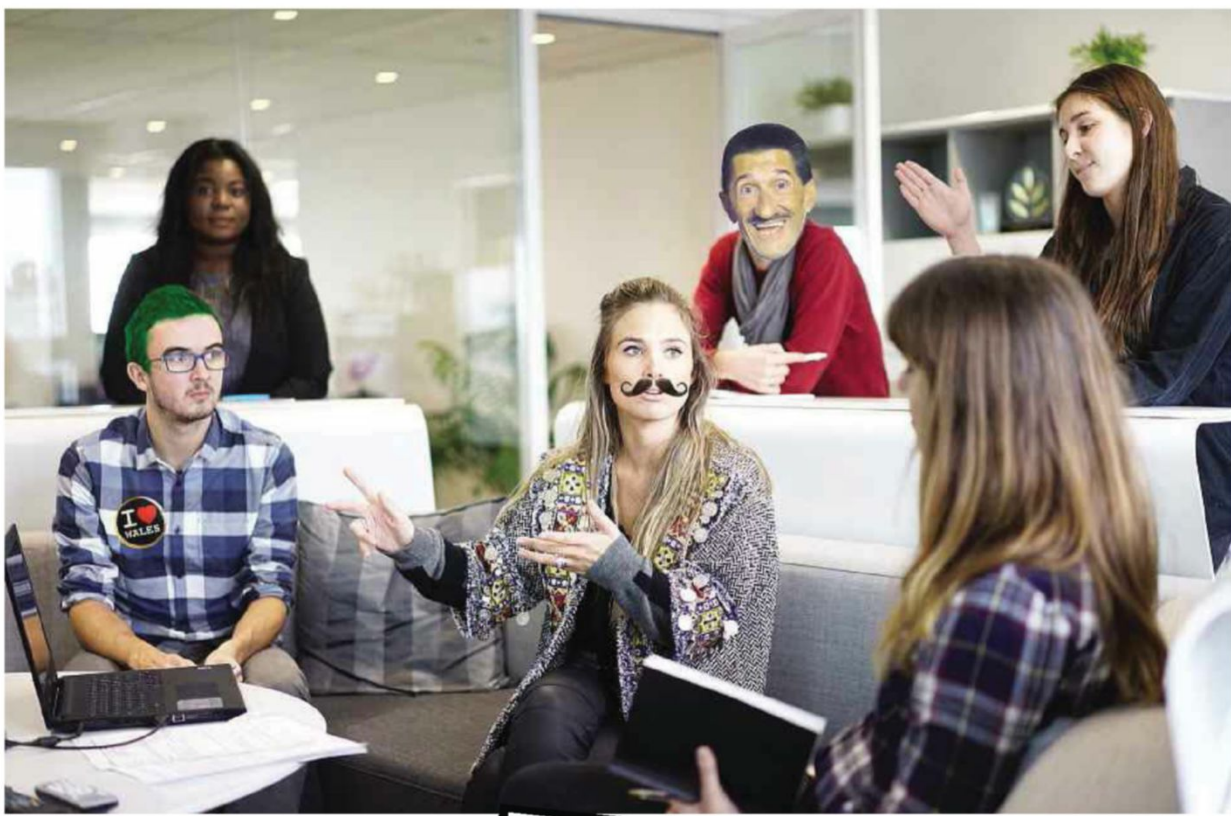


Fruit



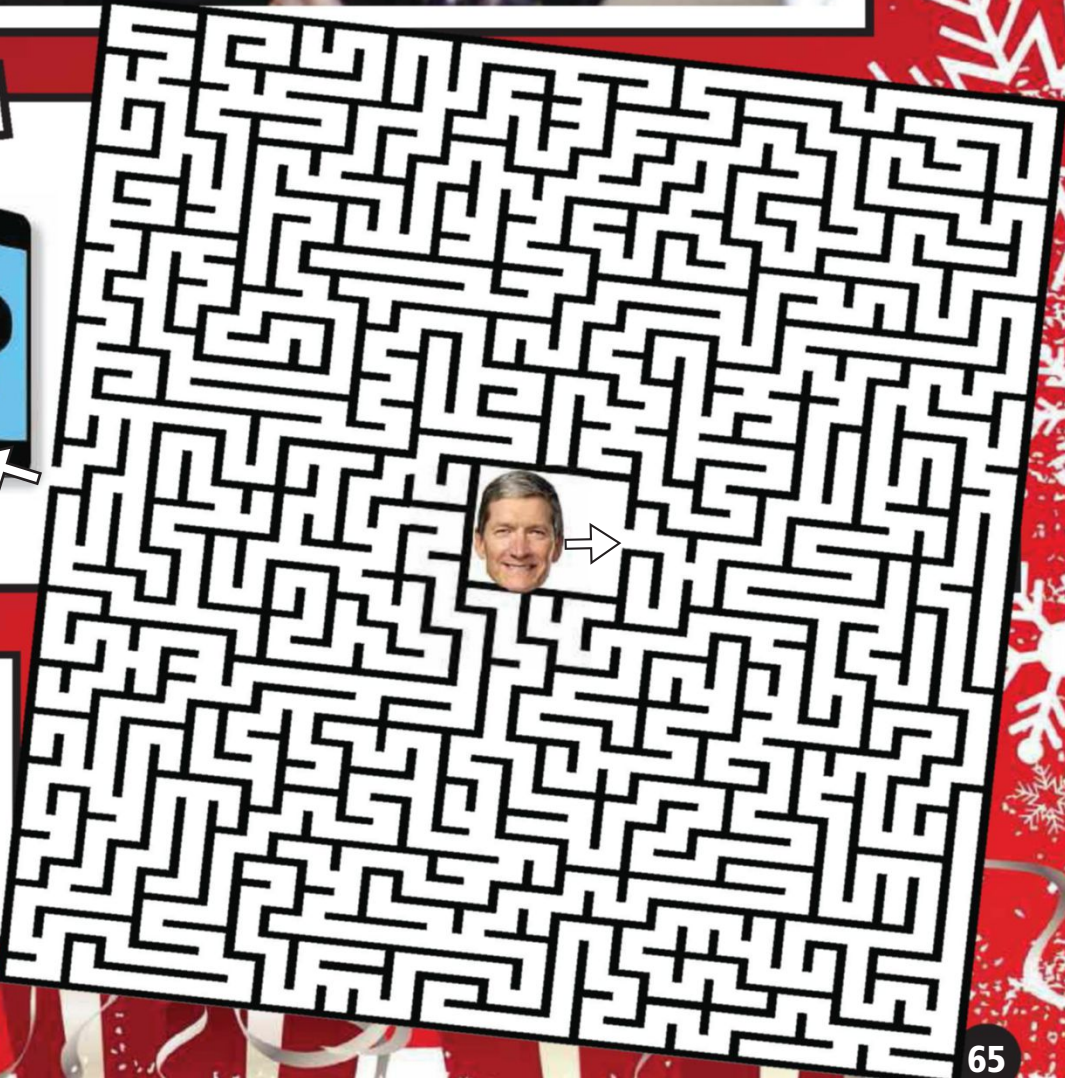
Christmas pudding





iPhone Emergency!

Oh no! Another absent-minded Apple technician has left a prototype iPhone in a pub. Help silver-haired CEO Tim Cook get to it, before some cheeky blogger stumbles on the phone and posts pictures of it on the internet!



Final Words

Merry Christmas to all our readers, our writers, our designers and everyone at Dennis Publishing who helps to make Micro Mart possible. Have a great new year too!

Retro Gaming News

The Best Of 2016

By the time you read this, we'll be in those last weeks, 'Last Christmas' will be playing in every store, and we'll all be wondering just where the last year went. Well, in my case, a great deal of it was spent firing up emulators to play (and review) new games for older machines. From puzzlers to platformers, space stations to Sam Mallard and *Invaders to Imperial Mahjong*, 2016 brought us a great deal of amazing new stuff. But in case you missed one or more of the Retro Round Ups over the year, and as we look forward to 2017, here's my definitive list of what you definitely shouldn't have missed downloading this year...

10. Exile 2: The Nameless

(PC (Windows), Ovine By Design, Free, tinyurl.com/hdnjcv)

If you ever owned a BBC, an Amiga or C64, then the chances are that, back in the late 80s, you played *Exile*. It was the first real open-world space graphic adventure in which you played Mike Finn and faced off against Lord Triax. To the delight of all those who wished for a second adventure for Finn, Ovine By Design created this sometime sequel. Personally, I still prefer the original, but this retro-themed title retains much of that classic's atmosphere. It couples it with some startling sound effects too.

9. Ilogical

(Spectrum 128K, Ubhres, Free, tinyurl.com/jqrrh5q)

Last year's countdown considered *Pixel Quest* to be 2015's most addictive retro release. *Ilogical* is a puzzler in which you attempt to build up the graphics from retro games of the past by following the 'knitting patterns' displayed above the grid of rows and columns. Slightly different to *Pixel Quest*, I found *Ilogical* a little less addictive, but it still



▲ Placing a remember teleport location in *Exile 2*

manages to keep me coming back to it time after time.

8. Sam Mallard: The Case Of The Missing Swan

(Spectrum 48K/128K, Ersh, tinyurl.com/hkgvryn)

Sam Mallard is something a little bit different for the Spectrum – a cartoon-themed crime thriller. You play a cigar-smoking private 'duckdetective' who has just been assigned a new case, where everything points towards some 'fowl' play. Although all done in monochrome, and although the puzzle isn't particularly taxing, this is a great way to while away a few hours and test your powers of 'de-duck-tion' (Sorry!)

7. Palace Of Magic 2016

(Acorn Electron, Everygamegoing, Free, tinyurl.com/z25s7at)

I grew up with the Acorn Electron, so I was always bound to get excited by a new game for this classic format. *Palace Of Magic 2016* is a colourful graphic adventure, which upgrades the old Superior/Acornsoft release with special effects, a speed boost and doubles the amount of colours on screen.

6. Let's Invade

(Commodore 64/128, The New Dimension, Free, tinyurl.com/goasgav)

This relatively new *Space Invaders* game for the Commodore 64/128 is a psychedelic feast for the eyes, which it's difficult to accurately sum up in text. A graphical and aural extravaganza, it features huge alien sprites, and it has so many surprises – all of which seem to happen completely at random! – that I suspect, even with repeated playing, I still haven't found them all.

5. Jewel Warehouse

(Amstrad CPC464, Ego-trip, Free, tinyurl.com/gvyc9yt)

A fun little platform game for the Amstrad CPC, *Jewel Warehouse* features all the classics – conveyors, drops, ladders and, of course, jewels. All you have to do is work out the fastest route to get 'em all before time runs out... Sounds easy, right?

4. Tourmaline

(Spectrum 48K, RetroSouls, Free, tinyurl.com/zmkjy3g)

What do you do when you've played

all the *Boulder Dash* and *Bomber Man* games? You equip yourself with *Tourmaline*, the only game (to my knowledge) that takes the frantic physics (and super-jerky scrolling) of the former, and the bomb-and-retreat placement of the latter. With hundreds of levels, and RetroSouls team behind the code, *Tourmaline* is a frenetic arcade game that is a blast in all sense of the word!

3. Imperial Mahjong

(Amstrad CPC464, Cargosoft, Free, tinyurl.com/zfh5a24)

Cargosoft's Amstrad games are always on an epic scale (Remember *Orion Prime* last year?) and *Imperial Mahjong* almost has the feel of a modern PC game. Of course, you know exactly what you're getting from its title alone, but this version has so many bells and whistles that it's almost like playing a work of art.

2. Amsthrees

(Amstrad CPC464, Glasnost Group, Free, tinyurl.com/z2genhd)

Year 2014 was the year of *2048*, the game that conquered every machine format from Vic 20 to PS4 and *Amsthrees* is a variation of that puzzler. You get a 4x4 grid, which fills up with blocks featuring numbers 1, 2 and 3... and you have to slide the blocks around to build up multiples of threes, by merging pairs and adding 1s and 2s. Concentrate hard and don't let too many empty places in the grid fill up with lower numbers.

1. Caren And The Tangled Tentacles

(Commodore 64, Prior Art, Free, tinyurl.com/j3xzky)

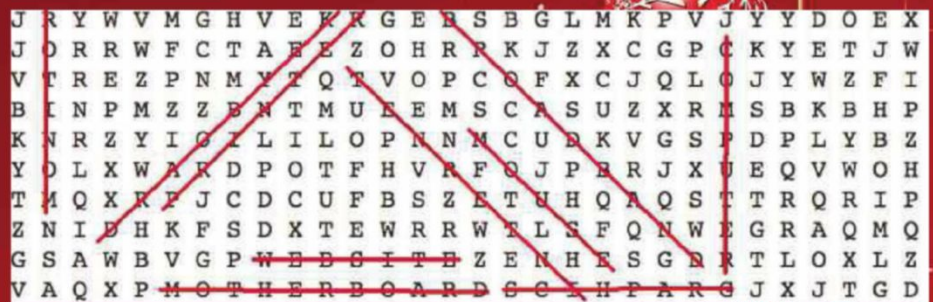
Caren And The Tangled Tentacles is a point-and-click graphic adventure in which you play a scientist who finds a dead body at her laboratory. I reviewed it in MM #1435, and it confused me with its lack of story and strange rooms full of wacky characters and odd objects. And it is a hard game to get into when you first play it. Yet, interestingly enough, it makes the number one spot this year. It does so because it has great graphics, great sound, a great user interface and, frankly, it's just a remarkable achievement on the Commodore 64. If you only play one retro game this year, then this is the one to get. [mm](#)

MM Puzzle Answers

Let's Get Quizzical!

1. d
2. b
3. d
4. c
5. c
6. a
7. c
8. b
9. a
10. d

A Word Search!



Guess The Christmas Tchie!

1. Bill Gates
2. Steve Ballmer
3. Sergey Brin and Larry Page
4. Linus Torvalds
4. Mark Zuckerberg

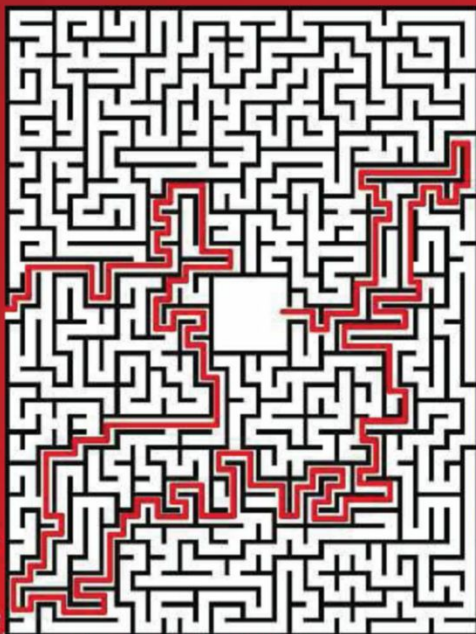
Spot The Difference!



Anagram Fun

1. Petaflop
2. Gigabyte
3. Turkey
4. Mince Pies
5. Mechanical keyboard
6. Santa Clause
7. Super computer
8. Christmas tree
9. High definition
10. Virtual reality

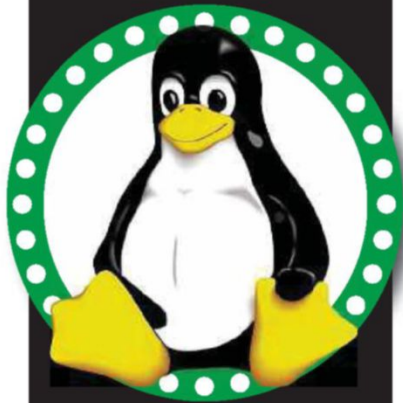
iPhone Emergency!



Famous British Inventors Christmas Dinner Mix-up

- John Logie Baird – Christmas pudding
- Alexander Graham Bell – Fruit
- Charles Babbage – Chocolate cake
- Tim Berners-Lee – Cherry Pie





David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Linux

Free Linux Books

There's always room for one more book on the shelf

I was looking for a specific book on Linux commands the other day, as a kind of re-learning and getting back to the CLI after I realised I had been spending far too much time using the GUI way of navigating and controlling Linux. After some Googling, I was quite surprised as to how many free books or eBooks, if you will, are available for Linux. Naturally, there are loads for other systems, programs and whatnots, but since it was Linux I was searching for they were the ones that cropped up.

Getting Started Guide to Linux
Stefan Neagu (goo.gl/5sXRQN)
Make Use Of often has some decent guides on its site, one of which is this handy getting started guide. Admittedly, it's looking a little old these days and tends to deal in distros that have since been updated many times over, but the core essentials are there regarding how to get a distro, burn it to disc or write to USB and how to install it. If you're a beginner, then this is still quite a useful resource that's worth a look.

Advanced Linux Programming
CodeSourcery LLC (goo.gl/Bklj0T)
As the title suggests, this is a more advanced look at developing within a Linux environment. If you already know C, and can find your way around Linux then I imagine this would be a great reference to have at hand. If you're just starting out, however, then there's enough in here to keep you busy for weeks on end.

Needless to say these are just the tip of the iceberg, there are hundreds more out there waiting to be read and absorbed by hungry minds.

All of this makes me wonder what else is out there – and what reading material you would recommend to someone who's starting out in Linux, or who is after something a little more specific to reference.

True enough, it's easy to simply Google a question, but more often than not you'll get an over-inflated answer or something completely wrong. That's where a good book comes in to its own and can help guide you to the path of enlightenment. Or so we think, anyway.

▼ *Books are great, how else would Sol have found out about Soylent Green?*

“ More often than not you'll get an over-inflated answer or something wrong ”

Anyway, I thought I'd share a few of the fine examples I found.

Linux Succinctly
Jason Cannon (goo.gl/283qZL) –
Linux Succinctly is an interesting book that helps you get to grips with the basics of Linux, specifically the command line, directory structure and so on. You'll need to sign up for a free account first, before you can download it, but that's not a big deal.

Bash Guide for Beginners
Machtelt Garrels (goo.gl/wNtFby)
Linuxtopia has an enormous collection of online books and tutorials for anyone to browse through. This one, though, focuses on Bash scripting, common shell programs, script debugging and much more. It's quite an achievement and one that's very easy to read too.

Rute User's Tutorial & Exposition
Paul Sheer (goo.gl/mIN03V)
This is an excellent book that goes into great depths covering Linux system administration for Red Hat and Debian systems. Both new users and more advanced administrators can get quite a lot from within its virtual pages, and those studying for Linux related exams would also find this a useful and handy reference.



Calendargh!

Another Apple cock-up bites the dust. Craig Grannell wishes bad Apple journalism would too

Most of the Calendar appointments I get are rather mundane: reminders from my wife that we have a dental appointment; something about taking the dog to the vet; a hint that it might be a good idea a week Friday to pick up the in-laws from the airport, rather than leave them stranded at Gatwick's South Terminal. (Believe me, that is never a good start to a visit). Recently, though, I was rather surprisingly sent an appointment that suggested I buy a pair of 'Ray Bans' for "only \$19.99". That seemed pretty cheap; perhaps it's the hyphen in real Ray-Bans that's the expensive bit.

It was only the latest of – well, if not many, then certainly 'some' dodgy invites. Every now and again, I've been getting them, usually from a sender with a distinctly Chinese name. It's irritating and irksome, and, you might be thinking, I should just delete them. The tiny snag is that Apple didn't think to include such an option.

When responding to a Calendar notification, there are buttons for Maybe, Decline and Accept. There's no Delete or Spam or Rain Down Hellfire On This Massively Annoying Buffoon. So you can either leave the notification lingering like a bad smell in Calendar or decline, thereby alerting the spamming spammer of spamville that the address they were using is active.

Only, that's not entirely true. You can instead jump through some hoops. You can nip on to iCloud.com (although only on a Mac or PC, mind, not an iOS device) and click a few settings to set event requests to be sent as emails rather than

notifications (for reasons known only to Apple engineers – and perhaps not even them – this is not a preference setting in the Calendar app itself). You then have to go through a convoluted routine of creating a new calendar, moving the spammy invites to said calendar and then deleting the calendar, hoping all the badness goes with it.

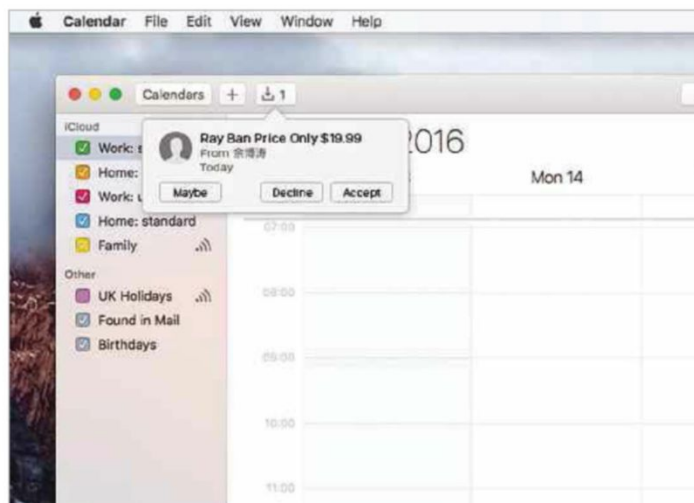
At this point you might be asking why Apple's so rubbish at dealing with this kind of thing. What we got was silence, followed by rumours Apple was looking into the problem, and then a brief apology and note that Apple was doubling down on weeding out dodgy senders – weeks after people first started complaining. Which suggests Apple is, well, normal. Human. Not staffed entirely by time-travelling magicians.

And that's the crux of it, when it comes to writing about Apple. You can begin a page of text like this seeking to slam the firm and shake your fist in the air, as if it will somehow make good everything that is wrong with the world that

happens to be encased in some metal with an Apple logo emblazoned on it. Or you can, in sunnier times, praise the company to the high heavens about something amazing (and plenty of genuinely amazing things have come from Cupertino, from the original iMac through to ResearchKit), as if somehow the entire tech industry will turn on a dime and become better – and that even includes Apple itself.

Perhaps the event technology journalists should put in their own calendars is one that starts today and continues until the end of time. It should read: think a bit more; write a little less; and stop considering that every little thing that happens within sight of an Apple logo is the worst tech disaster in history or the single best tech thing that's ever been seen. Even if either of those things does somehow happen to involve something to do with suspiciously affordable knock-off sunglasses from the Far East.

▼ *I don't think so, Spammy McSpamface. *click* Goodbye*



Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find Craig on Twitter at @craiggrannell

MiAc



Killer Fillers

Ian McGurren lines up the little fun bits for Christmas

So you've bought the big present for them; the phone, or maybe the tablet. So what else can you get for the mobile fan in your life (or for you, as you've been so good this year and you really do deserve a little treat)?

Under £15 – Stocking fillers are a bit of a head-scratcher sometimes, especially as tech this cheap is generally rubbish. However, a decent pair of Google Cardboard VR glasses can be found for £15 and under and are great fun – without needing batteries – and will suit most phones.

Alternatively, Amazon users could opt for the Dash buttons, the £5 connected button that lets you order from Amazon with one press. Failing that, vouchers for the App Store and Google Play Store are always welcome, especially with *Super Mario Run* on the horizon.

Under £100 – At this price point there's quite a bit of choice. One of the big releases of the year was Amazon's Echo, a mobile personal assistant trapped in a connected speaker. The Echo Dot is the budget (well, £50) version for those who want pretty much the same experience but would prefer to plug into their own speakers.

Along similar cool tech lines is the third version of Google's successful Chromecast media player. The addition of the word Ultra here might give you some idea as to the big change – yes, this is still much the same Chromecast as before, except it now works in 4K. So for you 4K TV owners you can now get

Netflix, YouTube and Google – but not Amazon – in glorious Ultra HD and for around £70.

If neither of those tempt you, there's always a smartphone controlled drone, such as the X5C from Syma which, as well as the drone part, offers a HD camera too. There's not a ton of flying time, at around five mins, but it's fun and it's certainly different and, at £35, reasonable too.

Money No Object – So they've got the watch, the tablet, the phone, the laptop, the drone, the 4K TV – what else could you possibly get them? How about a wifi-enabled smart fridge, where you can see what's inside it on your phone, watch TV on its door and even order food from its built-in touchscreen browser? Well, if you can

“ This is much the same Chromecast as before, but it now works in 4K ”

Over £100 – Got a Pixel or Pixel XL phone? Want to up your VR game? Well you can with Google's step up from Cardboard, Daydream. Closer in spec to the Samsung Gear VR, the Daydream headset is meant for the Pixel and Pixel XL phones, and to run the new Daydream software. There's also a small remote included for an all round better VR experience. It's not cheap at around £120 though.

Fancy something less in your face? How about the Apple Watch Series 1 and 2 (from £279)? Finally coming into their own, the Apple Watch has devolved into two series, both essentially the same, with the CPU now sporting dual cores, and the Series 2 boasting added waterproofing. Combined with the updated Watch OS, they're useful devices that easily last up to two days. The old model has also benefited from the OS update too and can be found even cheaper now it's discontinued.

afford the £3000 for one, then the Samsung Family Hub Smart Fridge Freezer might just be the one for you – just don't expect it to fit under the tree...

Hopefully, these will give you some ideas to help you find that perfect present, or even something to underline for yourself and leave open in an attention grabbing way – like you might have done with the Argos catalogue way-back-when... Have a great Christmas, and lets hope 2017 doesn't make 2016, look like 2015...



Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

Mobile

Flash Name For A Flash NAS

Andrew Unsworth salivates over a super-powerful NAS unit or two

Synology has shown us the future of storage with its FS3017 Flash Station NAS. This dual-processor monster uses two 2.4GHz Intel Xeon E5-2620 CPUs (each of which has six cores), no less than 64GB of ECC DDR4 RAM and two 10GBase-T Ethernet ports to create what is presumably a very fast and very powerful NAS unit.

The RAM can be upgraded to a maximum capacity of 512GB, should the 64GBs installed prove insufficient, and the FS3017 has capacity for up to 24 SAS or SATA SSDs. The FS3017 has a maximum single volume size of 200TBs for RAID 5 and 6 configurations and 108TBs for all others, with a maximum 1,024 volumes supported. The FS3017 has PCI expansion ports that allow the addition of items such as 40Gbit Ethernet cards. Oh, and it has two USB3 ports, too.

A graph on the Synology website claims the FS3017 will perform 987,047 sequential 4K read IOPS over a 10Gb Ethernet connection and 563,716 sequential 4K write IOPS, so it shouldn't have trouble pushing Ultra HD video to a TV or streaming tunes at a party. As for random read and write IOPs, Synology's website claims 374,988 and 241,981, respectively. All this means that it will happily communicate with many users concurrently without making them tap their thumbs on their keyboard impatiently.

Unfortunately for us mere enthusiasts, the Synology FS3017 costs £11,880, although that price does include VAT. If your office needs lots of people to have fast access to lots of data then the FS3017 is well worth a demo. For

general consumers, the FS3017 points to the kind of NAS we'll be using in the future, as all this technology will filter down to consumer units eventually. Hopefully, we won't have to wait too long for the 10Gb Ethernet ports to become more common to those on modest incomes. There are 10Gb Ethernet cards available at all the common online stores, but they're still too expensive to justify moving zeroes and ones across household networks, and even those of the average small business.

Thankfully, Synology has also announced something powerful for those with a more limited budget, and that's the DS3617xs, which is Synology's first to use an Intel Xeon D processor. The 14nm Xeon D-1527 runs at 2.2GHz as standard but has a boost speed of 2.7GHz. The CPU has four cores, which are split into eight logical cores, and the cores are supported by 6MB of cache

memory. The D-1527's 35W TDP suits its role in the DS3617xs. The CPU is further supported by 16GB of DDR4 RAM, which is expandable to 48GB.

This 12-bay NAS unit has a maximum capacity of 120TB. Even that capacity can be increased with the addition of expansion units that take the maximum raw drive capacity up to 360TBs of storage. If your small business handles a lot of data, then this could be the desktop NAS for you.

As for me, I need to upgrade the disks in my NAS to better the paltry 600GB capacity it is now. The good news is that there are now many disk manufacturers producing hard disks designed for NAS units. These disks have custom firmware and hardware that can more easily withstand being used 24 hours a day for 365 days of the year. Who knows? Maybe I'll treat myself to an early Christmas present.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none

Hardware



Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

In Plain Sight

If you've ever dreamt of turning into a coffee cup, then the new game from *Dishonored* has you covered

This week, Ryan checks out the new trailer for the *Prey* reboot and takes a look at Lego's latest MMO...

Plug & Play

Out next year, *Prey* could change the way we look at bins forever. You may remember the original *Prey* from 2006: a first-person shooter with some nifty sci-fi ideas – portals, out-of-body experiences, zero-gravity puzzles – and superb environmental designs. Courtesy of *Dishonored* developer Arkane, *Prey*'s getting a reboot, which is, as its designers admit, unrelated to the original game other than its premise: a lone player stuck on a space station full of aliens.

The twist in the new *Prey* is that the aliens can disguise themselves as inanimate objects: chairs, coffee mugs and, yes, bins. With guns and ammo in much shorter supply than they were a decade ago, players will be left with the slightly absurd task of sneaking around a *Mary Celeste*-like ship, bashing and prodding cups and bins to see whether or not they're a screeching alien in disguise – new protagonist Morgan Yu's weapon of choice being a trusty monkey wrench.

Looking at the latest gameplay trailer, released earlier this month, it's easy to spot traces of *Bioshock*, *Alien: Isolation* and the original *Half-Life* in *Prey*, as well as the sandbox philosophy that made *Dishonored* so much

fun; this is another one of those games that gives you a wealth of strange weapons and powers, then lets you deploy them however you like. That disguise ability the aliens have? Morgan can acquire that power, too; in one section, he transforms himself into a coffee cup and rolls through a small gap into an otherwise inaccessible room. Other weapons include a glue gun – which can be used to freeze aliens in a shell of sticky ooze, or sprayed into the air to create improvised walkways – and a kind of dimension-warping grenade, which effectively makes objects in its vicinity disappear into the ether.

Morgan will need all these weapons and alien powers, too; as well as the smaller, Headcrab-like critters scuttling around the station, there are huge, angry-looking monstrosities and even the craft's own robotic defence systems to contend with. The shooting, transforming action is accompanied by light RPG elements, a spot of crafting – where you can use a machine called a fabricator to create, say, bullets and medikits from items you don't want – and zero-gravity sections where you can find shortcuts outside the space station.

The new *Prey* has a neat retro-future look, too, thanks to an alternate history plot in which President Kennedy avoided the grim reaper and continued funding space explorations throughout the 60s; the result is Talos-1, the game's setting, which looks like an Ikea catalogue from about 50 years ago.

Exactly how all these shape-shifting aliens ended up on the Talos-1, and what other monsters and weapons *Prey* has in store, are all mysteries waiting for us in the finished game. Yet, with Arkane's *Dishonored* games also providing plenty of action and novel powers, its take on *Prey* promises to be one of the best, and potentially quirkiest, sci-fi shooters coming in the first half of 2017.

Online

2010's *Lego Universe* was the first attempt to meld Denmark's plastic bricks with a massive online world. The result was a solid adventure game that never quite broke through. *Lego Universe* was shut down in January 2012, due to lack of revenue, just at the point that *Minecraft* was starting to establish itself as a model for how a huge, creative multiplayer game should be done.



▲ *Lego Worlds* is the Danish giant's answer to *Minecraft*: a blocky MMO where construction, exploration and quests are all in the mix

Now, Lego – not to be outdone – is almost ready to launch its competitor. Developed by TT Games, *Lego World* really is strikingly like *Minecraft* in many respects: there's exploration and crafting, while building houses and sculptures is as big a part of the game as you'd expect. Lego's ringing the changes by introducing plenty of vehicles and other means of getting around: cars and helicopters nestle alongside dragons and horses, while a digger looks as though it'll provide a fun way of just smashing stuff up in a hurry. Indeed, one advantage *Lego*

Worlds has over *Minecraft* is its rich heritage of characters and buildings from the company's old Lego sets; as a result, you'll see maps populated by astronauts and wizards, cowboys, knights and one-eyed ogres. Lego's also planning to release a series of expansion packs for the MMO, each adding new characters, vehicles and weapons; how much – if anything – these will cost isn't currently clear, however.

Lego Worlds builds on *Minecraft* in other ways, too, with a greater range of creative tools to make building quicker, including an ability to select

pre-built pieces and drop them on the map, and a paint gun, which you can use to re-colour existing blocks. The game will also mix things up by introducing an overarching objective: if they choose, players can attempt to acquire the status of Master Builder by completing a string of quirky missions. These apparently include: "find a sword for a king, protect a farmer from a zombie invasion, or build a home for a caveman."

TT Games have been making Lego titles for the best part of a decade, and if you've played even one of them, from *Lego Star Wars* onwards, you'll know what to expect: playful humour and the kind of simple, addictive action that really can be appreciated by players of almost any age. With that kind of inclusive design expertise married to exploring and building on a huge, *Minecraft*-like map, *Lego Worlds* might have a chance of succeeding where *Lego Universe* failed.

Lego Worlds is due for launch on February 24th, 2017.

Incoming

You may recall the news that the wildly over-the-top shooter *Bulletstorm* is getting a shiny re-release, with a forthcoming *Full Clip Edition* adding high-resolution textures, more polygons and more frames per second. Well, developer People Can Fly has now announced that the new *Bulletstorm* is getting an additional campaign called *Overkill*, in which you'll be able to play through the entire game as none other than *Duke Nukem*. Given that *Bulletstorm* revelled in its own cheesy dialogue, like something out of an 80s straight-to-video action movie, the addition of Duke makes sense: in many respects, *Bulletstorm* is already the game that the long-delayed sequel *Duke Nukem Forever* should have been. People Can Fly's shooter may not have been a massive hit when it first came out five years ago, but who knows? Maybe this new release will help the game build on its existing cult following.

Bulletstorm: Full Clip Edition is out on 7th April 2017. **mm**



▲ Chaotic shooter *Bulletstorm* is making a 4K comeback, and this time it's bringing *Duke Nukem* along as a co-star

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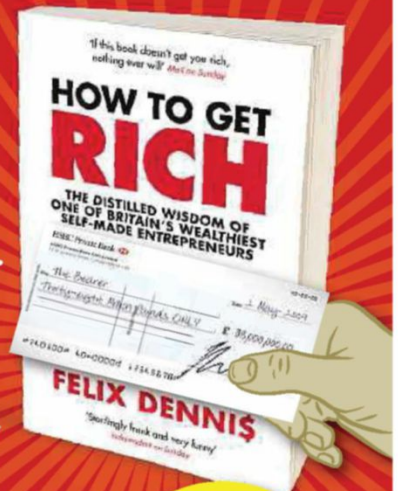
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Aaron

Where's My Stuff?

I'm new to computing, which will no-doubt become very apparent as you read my query. Simply, I cannot find files that I download onto my laptop. I go to a website and click to download the file, and that's it.

There's no pop-up or anything, the file is downloaded (at least I think it is), but I get no indication of where it should be.

I was under the impression that all files downloaded went to my users folder, or into the folder appropriately titled Downloads, but when I look there, I cannot find any files I've downloaded at all. So, I'm at a loss, and cannot find files I download.

The only way I've been able to do so is to run the file when I click on it. This can work for programs and installations, but if I want to download a file that I can't run, I'm lost. Please help.

Graham

I'm assuming you have a Windows laptop, but are not using Internet Explorer to download your files, and/or may have changed setting somehow with your browser of choice. The reason I say this is because the download folder

anything has been changed. You can do this by going in to your browser settings and looking for the downloads section. Here you should see the location the browser is using for downloads, and can set it to whatever you like,

“ Browsers will also allow you to specify where you want to download files ”

you'll find in your user account is used by many browsers, such as Chrome, and IE will use the Downloads folder you'll find in Explorer. As you're not seeing any files in these folders, you're either using a browser that doesn't use this location, or the defaults have changed.

This being the case, you'll need to check in different locations for these, and if

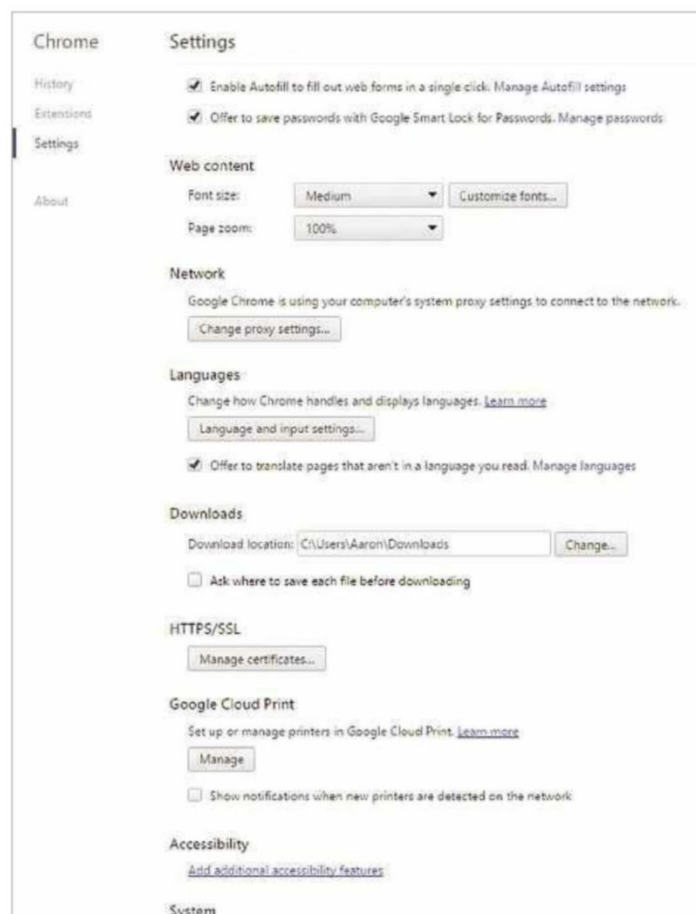
including the default user profile location.

In Internet Explorer, you can find this by opening up the browser and then clicking the settings icon (that's the 'cog' icon) to the top-right and then going into View Downloads. Not only will you find all of the downloads listed here, but you can click Options at the bottom-left and you'll be able to browse to the actual downloads folder, and can change it to something else.

In Chrome, a very popular browser, you'll find the downloads by default in your user profile download folder. To check this setting, open Chrome and click the ellipsis icon to the top right and select Downloads to view items. To check the location and change it, click Settings instead and then scroll down and click Show Advanced Settings. Here you'll find the downloads section where you can identify and change the folder used.

Both of these browsers, and most others will also allow you to specify where you want to download files manually when you click a download link. This is a good idea if you prefer to keep tabs on files, and often wish to download them to specific locations without having to move files after the fact.

< You can view and alter download locations used by browsers, and also opt to choose this manually



Snake Oil

I have a Snakescope, which is a USB powered bendy-necked camera, which is used for looking into awkward places etc. I bought the device back in 2011 to add to my collection of gadgets, however, when I came to use it the other day it wouldn't work on my Windows 10 laptop. I went to the firm's website (www.thumbsupuk.com), but it appears they are no longer in business, so I can't get any drivers for Windows 10.

So, my query is: have you any ideas how I can get this to work on my laptop please?

Jack

Often, many gadgets of this type are basically generic hardware fitted into a unique shell. The camera in this Snakescope, for example, could be a simple camera that Windows could recognise with its own generic drivers. However, that's not always the case, and if you've already tried using the camera with Windows, and have gone through the usual hardware install via Control Panel, you may need some actual drivers to make things work.

Luckily, I tried visiting the site in question, and found that it was actually working perfectly well when I got there. I also located the product, and a link to the drivers, which you can find at bit.ly/26lhiE7. The product manual is also linked and can be downloaded should you need it..



▲ Not all gadgets require bespoke drivers, but others will need to be installed with the correct files

I'm not sure what your issue was here, perhaps the company's site was down for maintenance. Nevertheless, the site worked when I tested it, so I'd recommend you give it another go.

Something Is Wrong

I keep getting the message "Something went wrong and we can't sign you in right now. Please try again later," when I'm trying to open my email. This has only started to happen recently, and has left me without access to email. Can you please help?

Isabelle

I'm not sure what kind of email you're trying to access, and which application or browser you're using to do so, so I can't be certain I'm on-point here, but I've seen this issue raise its head before. In these cases, users have been trying to open email via either Outlook or a browser. In most cases, the issue has actually been caused by corrupt files within web browsers.

The fix has been to delete all temporary files and empty the cache. If you do this, and go into your browser settings, you can remove these files and this may solve the issue. For efficiency, you can use keyboard shortcut to do so. For IE, Firefox, and Chrome, simply press CTRL+SHIFT+DEL to open the required dialog box.

You should also double check your Windows Update settings, as this problem is quite old, and Microsoft actually applied fixes to Windows some time ago to fix this, back before Windows 10, and even 8. If you're not running a later version of Windows, you may not have access to such a fix, but if you are, and you don't update your OS, you may want to do so, as this can fix a lot of potential issues, not to mention patch security flaws.



▲ It may not always seem related, but emptying your browser cache can help with various problems

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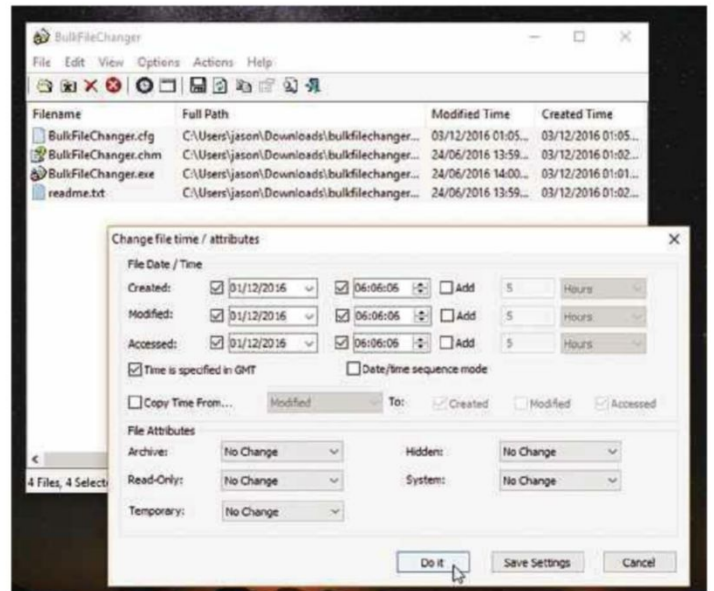
Jason

It's A Date!

I've produced a series of documents for work relating to internal policy, health and safety, and all that jazz. It's only a little thing, but to make them just that bit more professional, I'd like to give the files all the same date and time. I know Microsoft often does this with the files in software releases. How's it done, though? I can see no way to edit a file's date and time within Windows.

John, Merseyside

There's no way to do it directly within Windows, but all you need is a nifty little utility called BulkFileChanger. It's from a very clever chap named Nir Sofer, and you'll find it at goo.gl/OH3yQI (check out some of his other utilities too). It'll let you change the created,



▲ Time's up!

modified, and accessed details, and you can also alter attributes (read-only, hidden, and so on) – either on a single

file or in bulk. I won't bother to give instructions, John, as the program's simplicity itself to use.

A Good Pasting

In issue 1440, Cliff Evans was having all sorts of bother with his PC. It looked to me as though the motherboard was shafted, and I offered a few bits of advice. Well, like Arnie, he's back...

I've confirmed that the motherboard is at fault, and I'm about to order the replacement you suggested – the ASRock N68-GS4/USB3 FX. Now, when I swap the processor over – a lowly Sempron 145 (2.8GHz, single-core) – how should I apply the thermal paste? I hear some people saying it should be spread thinly and evenly across the surface, whilst I hear other people say it's best to clamp the cooler onto a pea-sized blob. I don't want to fry the processor!

Cliff Evans, BT

Our received wisdom once assured us that too much thermal paste was as bad as too little. We also believed that correct application was a black art. But as I've reported in these pages before, we were wrong. It was a load of old twaddle. Watch this LinusTechTips video, Cliff: goo.gl/tePYag.

It turns out that so long as there's enough, it's all good. Feel free to use a pea-sized blob, and also feel free to spread the paste like Lurpak on toast. As the video shows, it makes not a jot of difference.

The only caveat is that some pastes – not many, not these days – are electrically conductive. If such a paste oozes out over the motherboard, there's the

potential for shorts. I've never seen this happen, but in theory it's possible.

If you don't yet have any paste, I recommend Cooler Master's IC Essential E1 (electrically non-conductive). It's not quite as cheap as Chupa Chups – a 1.5ml syringe, good for multiple applications, currently costs £4.09 on eBay (including delivery) – but it's far from the most expensive.

Don't worry about frying the processor. If it gets too hot, it'll shut down automatically. Only serious abuse – massive overvolting when overclocking, for instance – can kill a processor. And with processors there's rarely any middle ground – they either work properly or they don't work at all.

▼ George Harrison wrote a song about this – 'My Sweet Lord'



Board Games

Here's a subject I touched on not so long ago. There's a lot of interest in this area, which is very good to see...

My ten-year-old son, Tom, wants a Raspberry Pi, mostly so he can practice his Scratch programming and maybe learn some Python. I think he wants to experiment with temperature sensors and so on. Would an Arduino be better, though? I've seen some ridiculously cheap ones on sale. Are they worth considering? Also, whether for a Pi or an Arduino, are there any kits you recommend?

Dan Griffiths, Surrey

Well, Dan, Pi boards are full-blown personal computers. They can run a graphical OS (typically Linux) and they have built-in video, sound, networking, and so on. The Pi 3 is essentially a budget smartphone without an integrated screen.

Arduino boards are microcontrollers. They're computers, but there's no video or sound or anything like that. On the Uno, the most common Arduino, the CPU is an



▲ **A computer for £1.99?**

Arduino company (where prices are much higher). A clone Uno can be had for as little as £1.99, or maybe £3.99 if you don't want it to arrive on a slow boat from China. Try Amazon or eBay. The Pi 3 costs around £30.

much more at home on the Pi – it's the platform's official language. C and C++ are more common on the Arduino (and much harder to learn).

On balance, for a ten-year-old, the Pi is probably the way to go, especially if that's what's used at school. However, as I've said, Pi boards aren't ideal for embedded-type projects. Maybe a Pi Zero – about £4 – is the answer? You may need to whip out a soldering iron with that, though.

As for kits, I'm not going to be much help, I fear. There are just so many to choose from. Your best bet is to decide on a project that'll be fun and fairly easy to complete and buy a kit that has the relevant parts. You can add extra parts as you go along. As always, eBay and Amazon are your friends. And if you do decide to go the Pi 3 route, why not buy a basic Arduino kit at the same time? It's possible to bag an Uno, some LEDs, some cables, a breadboard, and numerous other bits and bobs for under a tenner.

“ For a ten-year-old, the Pi is probably the way to go, especially if that's what's used at school ”

8-bit job running at 16MHz, coupled with 2KB of RAM and 32KB of storage. No – those aren't typos.

So, it comes down to what sort of projects your son is interested in. If any kind of grunt is required, or if there'll be user-interaction via a screen, he'll need a Pi. However, by the sound of it, as he wants to mess about with sensors (and perhaps lights and motors – robotics?), an Arduino may be better.

One consideration is that a Pi is usually powered by a micro-USB phone charger, whereas an Arduino just needs three AA batteries and therefore has great portability. Another consideration is that Pi programs can be written using the Pi itself, whereas Arduino programs have to be written on a PC and then uploaded over USB.

The cheap, clone Arduinos are fine, Dan. Indeed, they're what most people buy. The Arduino platform is open source, so anyone can make compatible boards – there's no need to buy from the actual

Both the Pi 3 and Arduino Uno offer a huge range of add-ons, and there's a metric ton of official and unofficial help. Scratch is supported on both – in the case of the Arduino, take a look at the MakeUseOf article at goo.gl/o6yrzz. Python is possible on the Arduino, but it's

Bits And PCs

This issue of the mag is on sale for two whole weeks, which can mean only one thing. Merry Christmas! Or, if it's not your bag (nothing wrong with that), Happy Holidays! If you've bought the mag early on, Santa won't have visited yet. If you've been a bit slow off the mark, though, here's hoping you didn't take anyone's eye out when the buttons broke loose after the slap-up meal.

Anyway, I wish you all very glad tidings. If you get bored of stuffing your face, want to wax lyrical about your new gadgets, or are simply feeling low (I'm not much of a live wire myself over Christmas and New Year), feel free to pop up for a chat on Facebook. I'll be online right over the holidays. I'm at www.facebook.com/jasondallison.

I'll be back for one final spin of the wheel a couple of days before New Year. As you're probably aware by now, friends and neighbours, the next issue of Micro Mart is not only the last of 2016 but also the last of all time.

Crowdfunding Corner

Retro computing projects tend to be a labour of love, so it's no surprise they end up on Kickstarter. Here are two retro-themed computing devices that'll take you back to the days when games were games...

Raspi Boy

Based on the Raspberry Pi Zero, the Raspi Boy is a handheld games console designed for emulation, with a built-in controller and custom-made casing. Designed to be easy-assembly, you can put a Raspi Boy together from its raw parts in five minutes. All you need to do is add a Raspberry Pi Zero and you're away.

Of course, the kit doesn't include the emulation software and games for legal reasons, so it's up to you to make sure you've got those covered in whatever way your conscience allows. Other than that, you'll find it's able to connect to HDMI screens and accept additional gamepads through USB for up to four-person multiplayer gaming. It has a built-in speaker, headphone jack and thumbwheel volume control.

Your kit includes the case, screen, controller board and buttons, battery, console control board and an 8GB SD card, and there are extra upgrades available to buy if you like (such as a larger battery). The whole package costs just €69 (£58) though if you're lucky there might still be cheaper early bird prices available when you read this. The project's €50,000 seems easily reachable, but the earlier you back the earlier you'll get your hands on one!

URL: kck.st/2gaJMF6

Funding Ends: Friday, January 6th 2017

Allcade Retro Consoles

Allcade previously put together the Allcade 5000, a retro gaming system in a full-size arcade cabinet. Now it's going in the opposite direction with the new Allcade, which fits an entire retro gaming console inside the Nintendo cartridge of your choice.

The device comes in three main flavours: the 8-bit Allcade, which is housed inside a NES cartridge case with a USB Allcade Controller (resembling the classic NES controller) and power supply. The 16-bit model has a (US-style) SNES cartridge and USB controller, while the 64-bit model comes inside an N64 cartridge with an N64 controller. Each version is backwards (but not forwards) compatible and is based on a Raspberry Pi 3, so it's easy to add new emulators and games. You can even pay extra for additional controllers.

If you don't mind a bit of soldering, the cheapest version comes completely disassembled and costs just Can\$30. Pre-assembled 8-bit Allcades cost Can\$149, while the 64-bit Allcade costs Can\$199. The project just has to hit its Can\$10,000 goal and we don't think there's much danger of that not happening. Assuming it does, devices will aim to ship in January 2017, so there's not much time left. Much better than a Mini-NES!

URL: kck.st/2gCHKK4

Funding Ends: Sunday, January 1st 2017 mm



Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

Hypocam

Viewing the world through a monochromatic lens

There's an art to black and white photography, something that's more difficult in many ways to that of traditional colour photography. To capture a great black and white image, you need to think more about the subject in question. You need to consider the scene, the emotion behind it, while still capturing the image's story.

Back in the day, when people used to develop their own film, great black and white photography was something of a higher level photographic skill. These days, well since the advent of computer image development and digital photography, most folk are able to achieve some great results with the minimum of fuss. The new generation iPhoneographers and the like have some pretty impressive tools at their disposal. Nevertheless, I've always felt a little disappointed at what's available. Until now.

Hypocam

I've been playing with Hypocam on my Samsung Note 4 and, to my amazement, I've taken some really good black and white shots. Certainly better than a photographer of my standard can usually manage.

Hypocam allows you to take stunning black and white photos and apply various filters and film grain effects to those photos. You can adjust the contrast, crop the image, rotate it, add a colour filter, fade and alter the grain effect with D-400, FP4, HP5, T-Max and T-Rix film emulation settings.

There's the option to post images to Twitter, Facebook and Instagram – and also to 'The Board', a curated Hypocam gallery where your best work can be showcased alongside and for other App users.

Capture The Essence

Naturally there are countless other image editors and filters available for Android and iOS, so what makes Hypocam stand out from the crowd? For one, Hypocam is extraordinarily simple. It's easy to shoot images, easy to subtly apply the filters and tweak the finished photograph, and there are numerous tools available beyond the default to help you find the perfect finish to your image.

Secondly, Hypocam is a community inspired app. The front page contains images from photographers and writers, helping you to find your inspiration and perspective. Also,

Features At A Glance

- Free
- Shoot great black and white photos and videos
- Many filters and grain effects make for some stunning images
- Extra filters and tools available for a small cost
- Share and be inspired by other users' images

there's The Board, where you can view other members' images and find that spark of inspiration for your own pictures.

Conclusion

While I'm no expert photographer, I've found Hypocam to be a great app for helping me capture those perfect black and white shots. The included filters allow me to tweak the image without the need to load them into a photo editing program, and the ease of use is something I'm really beginning to appreciate.

It's not the only photo editor available, but Hypocam is certainly one of the better apps I've used recently. What's more, it's one that'll stay installed on my phone while I'm still able to take photos with it. [mm](#)



▲ Some of the examples in The Board are simply stunning and a great source of inspiration if you need it



▲ Hypocam is a superb black and white photo app and editor



▲ Black and white photography is really wonderful when done right

Logging Off

Regular readers may have come to understand that I'm a keen player of Wargaming's *World of Tanks*, although I play a few other titles. As with other online multi-player titles, this game allows you to interact with other players through the mechanics of the game, and also through an integrated messaging system. However, truth be told, the longer I've played the less attractive that's aspect has become.

Trolls, griefers, whatever name they'd like; with each 30 user battle comes at least one such person – often a selection of them – who seems to put the majority of their effort into the harassment or abuse other players, or causing entirely unwanted distractions. It's not just me that's noticed this, either; Wargaming has already removed the global chat channel in a previous patch, because too many players thought it was hilarious to ruin the game of those left alive on their team by giving away their locations to the other side once they'd died. So now, thankfully, we don't hear a stream of garbage from the other side, but is that enough?

It isn't, I soon concluded, and I've since deactivated my chat mechanism entirely. Some of you reading this will think I'm bonkers, because surely the purpose of chat is to enable coordinated actions on the battlefield through teamwork?

That's definitely the theory, but in roughly 27,000 battles I've fought in this game, I can count the number of times this happened on one hand. That's either because those I'm playing with/against don't speak the same language, won't coordinate, or even go AFK at the critical point in proceedings. This might seem depressing, but that I'm still playing this game demonstrates that doesn't entirely scupper the whole experience for me.

So how is my chat-free experiment going? For the most part, quite well as it happens.

So far, I've only had one situation where it might have helped – when I accidentally flipped my tank on its side and needed a push to get back on my tracks. I could still send a standard 'Help' call, but nobody came to find out why I might need it.

That said, the very same thing happened a week before when chat was enabled. Then, I called for help explaining precisely why I needed it, and nobody came to render assistance anyway.

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The positive aspects are that I'm now much more focused during battle, am getting better at reading the strategic clues of the mini-map, and intervening where I will make the most difference. That my kill ratio hasn't significantly declined or improved yet hints that whatever chat was contributing before was neither vital nor debilitating. I believe if it was used in the way Wargaming intended, it would be helpful, but that's not what's going on. At the end of the day, I'm enjoying playing more than I was. That, for me, is the true litmus test here.

I suspect this problem isn't unique to this game. While inexperienced players can get good advice from seasoned ones through chat, it's naïve to think that it's exclusively used that way. My experiences include some harsh lessons about what many find to be acceptable behaviour, and others don't.

This isn't a reality that's exclusive to this game. There are far too many people out there who seem to equate the Internet with zero rules and no accountability, regrettably.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Eavesdropping, 8 Schema, 9 Sickie, 10 Jamaica, 12 Excel, 14 Adata, 16 Measure, 19 Steely, 20 Remedy, 22 Colloquialism.

Down: 1 Calc, 2 Genera, 3 Advance, 4 Boost, 5 SpaceX, 6 Engineer, 11 Audition, 13 Terrain, 15 Treble, 17 Sample, 18 MySQL, 21 Dash.

DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. Dealing with Christmas, certainly at the ages most of the Micro Mart team are, is largely about denying one's natural instincts and understanding that it's Not All About You. As such, not only do we have to put aside our natural state of humbuggishness (see last week's Disclaimer for more details) in order to rustle up the requisite bonhomie the season

demands, we also have to accept the reality that we're probably not going to get what we want. Our coping mechanism for this is to condition ourselves to accept that socks are a handy necessity, shower gel useful, Jamie Oliver cookbooks good for sticking under monitors to raise them to a comfortable height, Christmas bonuses a non-starter, a peaceful and/or prosperous new year unlikely until the kids finish University in 2025 (and then only slightly less unlikely), the January sales just around the corner, and our significant others don't know about the money we squirrelled away for that VR headset earlier in the year. Oh, did we say that last bit out loud..? We did..? Okay, well, hopefully you don't know our significant other and we can trust you not to give away our little secret... More Stollen, Vicar?

THIS WEEK'S CROSSWORD

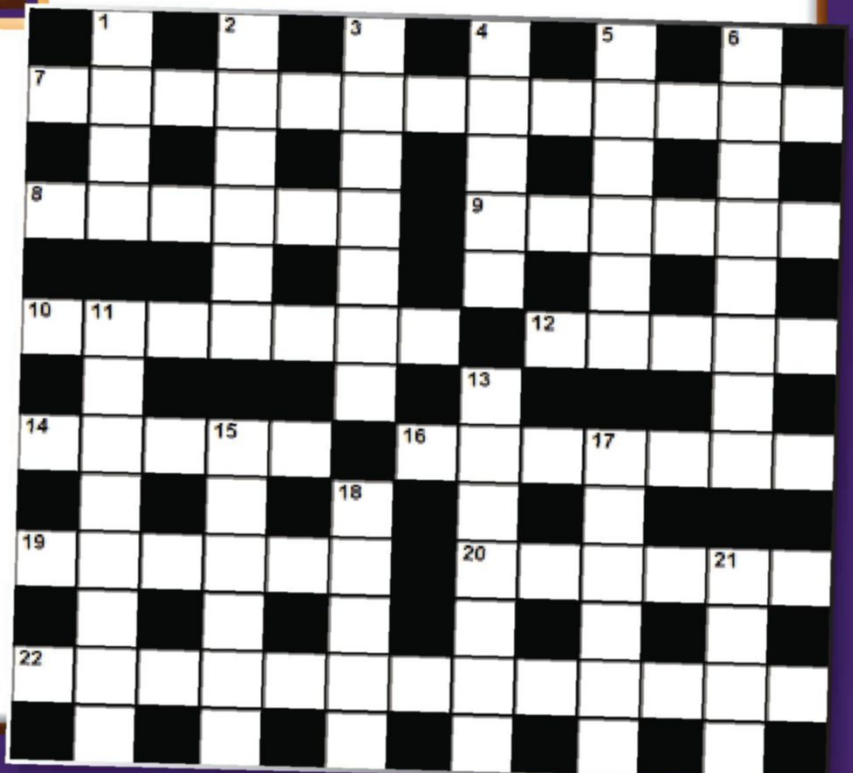
Across

- 7 .li TLD (13)
 8 A series of twelve manned American orbiting spacecraft, launched in the 1960s in preparation for the Apollo programme. (6)
 9 An optical illusion caused by atmospheric conditions, especially the appearance of a sheet of water in a desert. (6)
 10 Left out or excluded. (7)
 12 Acronym for programming language created in 1959 and once popular for creating business programmes. (5)
 14 A sudden and brief spell of an activity or sensation. (5)
 16 The villain from Mega Man X3 (also surname of the prominent 19th century Austrian mathematician and physicist) (7)
 19 The art of growing ornamental, artificially dwarfed varieties of trees and shrubs in pots. (6)
 20 The quality of threatening evil. (6)
 22 Between or among galaxies. (13)

Down

- 1 A nuclear reactor that uses controlled nuclear fission to generate energy. (4)
 2 A file containing a list of commands

- that can be executed automatically in one go. (6)
 3 A type of character in the King of Fighters video game series. (7)
 4 A diminutive spirit in Renaissance magic and alchemy, first introduced by Paracelsus in the 16th century. (5)
 5 Sound that is directed through two or more speakers so that it seems to surround the listener and to come from more than one source. (6)
 6 Frequently irritating sequence of sounds or music alerting mobile phone users of an incoming call or message. (8)
 11 Microsoft's popular map data visualisation software discontinued in 2014 making way for Power Map for Excel. (8)
 13 A representation of a substance using symbols for its constituent elements. (7)
 15 In music a set of staves that indicate instruments or sounds that are to be played simultaneously. (6)
 17 A written contract or certificate of insurance. (6)
 18 Surname of the Physicist and Nobel Prize laureate whose name is associated with a particularly well known boson particle. (5)
 21 The Magnet Pokémon. (4)



In Next Week's Micro Mart...*

- ◀ The big farewell issue...
- ◀ Technology companies and class action lawsuits
- ◀ How Apple changed the world
- ◀ Is VR ready to become a reality?



*May be subject to change



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